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The Dock & Harbour Authority

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CONTENTS

Editorial Comments

The Port of Le Havre.

Le Havre, situated on the estuary of the Seine 143 miles from Paris and 55 from Rouen, is the second largest seaport of France, and was of some importance as early as 1572, when vessels were despatched to the whale and cod fishing grounds off Spitzbergen and Newfoundland.

In the 17th century, Le Havre became the principal port of the French East India, Senegal and Guiana Companies, while during the Napoleonic era, the port became a naval base and war harbour of the first rank.

During the first World War, the safe anchorage and harbour, and extensive quays, sheds and other dock facilities of the port, enabled both British and American armies to use it as a base for landing troops and stores, The same procedure was adopted in a modified degree in the last war.

In the port there are now fourteen basins and docks and more than eight miles of quays,, the principal ones being the Bassin Bellot and Bassin de l'Eure, the mail steamers of the Compagnie Generale Transatlantique being berthed in the latter. There is a regular shipping service with New York and with many other ports of Europe, North, South and Central America, the West Indies and Africa, the principal imports being cotton, coffee, copper and other metals, wool, rum, foreign wines, oil seeds and dye woods, while the industries of the town are rope making, timber and wood work for building, wire drawing, machinery manufacture, flour milling, oil refining, dye extraction from woods, spinning and weaving, toy making and chemical work.

A feature of the port is the Tancarville Canal which enables lighter and barge traffic from Rouen and Paris to avoid the Seine Estuary.

The amount of damage suffered by the port during the last war was most extensive, and the chaotic condition to which the port and installations had been reduced by Allied air raids and the systematic demolitions by the Germans, must have presented to the engineers of the Ponts et Chaussées problems of extreme intricacy and a task of great difficulty in organising and carrying out the work of clearance and reconstruction as described in the paper by Monsieur Callet, which we reproduce by kind permission.

Several items of technical originality and interest are involved in the work, the principle one being perhaps the method of reconstruction of the full section or mass concrete portions of the Joannès-Couvert Quay, founded originally upon rectangular steel caissons, involving the use of pre-stressed concrete beams on the Freyssinet system.

In some places these caissons only remained intact, and being, of course, below water, the method of reconstruction of the new quay wall upon them is of particular interest, being carried out by means of concrete boxes filled, after some unsuccessful attempts, by injecting colloidal mortar into the aggregate filling, a method which appears to have been quite efficient.

Readers will examine with interest the 9-metre diameter cylinders and the 1.50-metre piles sunk by the " Benoto " grab system used at other quay sites.

The unusual box type of pre-stressed beam and reinforced concrete caissons used for the Escale Quay should be also observed.

The design of the roof of the new shed on the Joannès-Couvert Quay is unique. Presumably the 18-in. rolled steel joists which were transformed into 30-in. open webbed girders were on hand at the site and of no immediate use for normal purposes, otherwise it is somewhat difficult to see how this form of construction could be an economic proposition.

As Monsieur Callet says in his closing remarks, although local conditions may have determined the methods of construction adopted at Le Havre, there are many aspects and ideas of which more general application elsewhere could be made.

When it is considered that Le Havre is only one of the many French ports severely damaged during the war, and how work must have been hampered by the lack of plant and man-power and the disorganisation of the railways, roads and canals for transport of materials, the magnitude of the task and the ingenuity displayed in overcoming the difficulties of bringing about the rehabilitation of the port deserve especial commendation.

International Labour Organisation Congress.

In this issue, we devote some space to the Reports prepared by the International Labour Office, in accordance with the Resolutions adopted at the Second Session of the Inland Transport Committee of the I.L.O., held in Geneva during May, 1947, for study and discussion at the next Session. These reports therefore formed the agenda for the Third Session of the Inland Transport Committee which was held in Brussels recently.

The subjects covered by the four Reports are very diverse, and are, of course, concerned with labour conditions in all forms of transport, and while all of them are deserving of study, that dealing with decasualisation of Dock Labour is naturally of greatest interest to Port Authorities.

The Review of the work of the Sub-Committee written by the Vice-Chairman, Mr. D. F. Macdonald, forms an interesting précis of the discussions, and resolutions passed to the main Committee.

A point towards which attention was directed by the International Labour Office in Report II was the advantage which might be ob-

Editorial Comments—continued

tained by concentrating shipping in a smaller number of ports. Apart from the stabilisation of employment which would be gained by the same volume of traffic being handled by fewer ports, it was also contended that the increase in size of ports would justify further investment of capital in equipment, with a consequent increase in efficiency of cargo handling.

The difficulties and objections to such a policy are, of course, apparent, and it is not easy to see that any reduction in the number of small ports is possible in this country or even desirable; for the smaller ports more or less specialise in the handling of cargoes in small vessels to which they are well adapted, from the point of view of their situation in respect to inland transport, proximity to areas of local production or demand, and so on.

As far as the United Kingdom is concerned, the whole question of priority of large ports and the complementary position of smaller ones, is being dealt with by the Ministry of Transport in the study of the nationalised ports now being undertaken by the various working parties set up for the purpose.

The mechanisation of cargo handling together with improvements in stowage technique aboard ship, and the relationship of these developments to dock labour are intimately connected. They do not, however, appear to have been discussed by the Committee, although it is a matter of the utmost importance, requiring considerable clarification and the formulation of an equitable policy agreed to by the employers and trade unions concerned.

Such a policy should aim primarily at ensuring that, after a reasonable return on capital invested by the employers on labour-aiding devices, any reduction in handling costs should result in lower prices to the consumer and in benefit to employees by improvement in working conditions and an increase in the volume of work. This latter objective would probably be gained by the quicker turn-round of shipping and should not be the result of any reduction in the numbers of port workers. Unless some such principle is established, the prejudice of dock labour against any innovation will never be overcome.

It is interesting to observe that the most advanced scheme in respect to decasualisation of dock labour generally, was considered to be that of the United Kingdom. At the same time, however, it was to be expected that a system suited to our port conditions and social and economic background does not necessarily constitute a system applicable to all nations, although the basic or fundamental principles of dock labour organisation appear to be capable more or less, of universal application.

The free discussion and interchange of ideas, with or without full agreement or even complete disagreement, on all points considered by the Inland Transport Committee, cannot produce anything but good results. A great step in the advancement of the ideal of the Commonwealth of Nations is therefore being made by the International Labour Organisation. for the ports and shipping of the world form one of the most important points of contact between nations.

European Transport Developments.

With regard to the three other Reports of the International Labour Office referred to above, Report No. 1 also contains several items of interest, giving as it does a review of Recent Developments in Inland Transport—Railways, Roads, Canals and Rivers—of the principal countries of the world, both in respect to economic trends in the relationship to one another of all forms of transport and labour conditions generally. It is to be observed that the recovery of inland navigation in the post-war period has been markedly slow, the reason ascribed being the extensive dislocation and damage caused by the hostilities. On the other hand, very good progress is now being made in most of the European countries in the reconstruction and repair of canals and the rebuilding and modernisation of the inland navigation fleets.

When the work on the Rhine-Main-Danube Canal is completed, it seems likely that the Danube will be able to fulfil the function of a link between East and West which its geographical position seems to have assigned to it. Certain developments concerning, in particular, the freeing of Rhine navigation between the Netherlands, Belgium and Germany, have set conditions for a greater utilisation of inland water transport in the future. It may also be mentioned that in France the Monnet plan contemplates increasing the activity of Inland Water Transport in 1950 to 30% above 1938.

Inland Water Transport.

The article by Mr. Ives on the Inland Waterways of the United Kingdom published in our issue of May last, together with the letter on the subject by " Windlass," which appeared in our June issue, has elicited a further communication on the matter, by the Chairman of the Inland Waterways Association, to which the attention of our readers is directed.

With regard to his suggestion that a detailed survey should be made of the Inland Waterway resources of this country; this we imagine will be one of the first tasks of the Executive now that the transitional stage has been passed. Investigation into the question of rates and tolls is of primary importance in order that any anomalies in this respect may be eliminated. The rates should be so cast as to attract to the canals that class of traffic which they can handle economically and satisfactorily, having regard to the carrying facilities offered by both railways and roads, so that, as we have said before, the three services may complement one another and not engage in harmful rivalry. Some degree of competition is healthy without doubt, and for this reason, we would welcome a publicity campaign as soon as the question of tolls has been settled and the canals themselves are repaired and in a position to deal with a large volume of increased traffic.

It is pertinent to refer here to the attitude of the Government of the United States of America to inland water transport, which is fully dealt with on a following page. We would also draw particular attention to the remarks by Mr. Chester C. Thompson concerning the difficulties experienced by the Carriers on American Waterways in overcoming opposition by the railways and other rival organisations. It would appear from what the speaker said, and from similar statements from other countries, that rivalry between various forms of transport is not confined to the United Kingdom.

Making due allowance for the difference in relative importance of Inland Water transport of Foreign countries and the United Kingdom, it can be assumed, we hope, that our canals will not again be allowed to be sacrificed for the sake of railway profits and we look forward to an early public statement on the part of the Docks and Inland Waterways Executive as to a national canal policy and the place it is intended the waterways will occupy in the transport system of Great Britain.

The National Rivers and Harbours Congress of America.

We are fortunate in being able to reproduce at this important stage of the co-ordination of the Inland Waterways of this country, some interesting addresses presented to the above Congress at the 39th Annual Convention held in Washington, D.C., in April last.

It is a significant fact, which Mr. Larcade touched upon in an address presented by him to the Congress, that China, India and the ancient civilizations of the Middle East, which in the past, through diffidence, wars or some other economic reason, failed to protect their rivers and harbours and to prosecute schemes of flood control and irrigation, either decayed and so were reduced to low living standards, or disappeared entirely.

In studying American inland waterways problems and comparing them with those of the United Kingdom one must not, of course, lose sight of the fact of their great dissimilarity in point of sizes and distances. It also must be borne in mind that most of the waterways projects in the United States are ones of canalization of rivers and are intimately bound up with questions of flood control, irrigation and hydro-electric power supply. At the same time however, it is interesting to realize that many of their problems have been largely resolved by the permanent establishment in the United States of inland waterways as a vital element of transportation. We sincerely hope that this state of affairs will also come to fruition in the near future in the case of Britain's transport system and that the implementation of a progressive policy will be carried through with the foresight and vigour, which the matter deserves.

The Port of Le Havre

Account of Post-War Reconstruction of the Harbour

By M. P. CALLET
(Ingénieur en Chef des Ponts et Chaussées, Directeur du Port Autonome du Havre).

INTRODUCTION.

On the 18th November, 1948, the Ninety-Fifth Ordinary General Meeting of the British Section of the Societe des Ingenieurs Civils de France was held jointly with the Institution of Civil Engineers in London, when the following paper, which is being reproduced by kind permission, was presented by M. P. Callet.

At the beginning of the Meeting, **Mr. M. G. J. McHaffie,** M.Inst.,C.E., President of the British Section of the Société des Ingénieurs Civils de France (Chairman), said that they had a distinguished French engineer to present a paper, M. Pierre Callet. After going through the Ecole Polytechnique and Ecole des Ponts et Chaussées, M. Callet became an Engineer of the Highways Department in 1926. In 1928, he went to the Strasbourg Port Authority, and was in charge of navigation on the Rhine from Basle down river to Strasbourg. In 1937, he was appointed to the Havre Port Authority, where he was in charge of port operation and equipment. In 1942 he was appointed Engineer-in-Chief and Assistant Director, and then in August, 1944, as Director of the Havre Port Authority—he was, therefore, now Chief Engineer and Director of the Port. After working throughout the war with underground intelligence movements he acted as Prefect in the months following the liberation of Le Havre. M. Callet was also an Officer of the Legion d'Honneur and a Companion of the Liberation.

Those who had seen the destruction wrought upon the Port of Le Havre by the Germans would realise the immensity of the task that M. Callet and those associated with him had to face in bringing about its rehabilitation. At the same time, they would be impressed by the tremendous amount of work that had already been done and which M. Callet would describe in his paper.

M. P. Callet (speaking in French) said that first of all he must apologise for the fact that he was unable to speak English. He had an idea, however, that many English people knew more French than they said or thought they did. Since he had been in England it had been his pleasure to learn what he could from English engineers, and he was very conscious of the honour of having been given the opportunity of presenting a paper before such a distinguished assembly. If that paper was found to be of interest it would be because the French engineers had, of necessity, had to adopt procedures which were somewhat original. Necessity was an excellent teacher and because of the magnitude of the task which they had had to accomplish and the difficulties which they had encountered the engineers concerned with the reconstruction of Le Havre had had necessarily to think less of method and more of using their intelligence in their work. It was for that reason that he asked the meeting to consider what had been accomplished there not only as the result of technique but also as the result of whole-hearted co-operation between a number of people.

The following paper was then read, in English, by **Mr. P. Gerard,** M.Soc.C.E. (France).

OF all branches of public works, maritime works have always been one of the most stirring, as there is perhaps no other one in which so many technical and human problems and data interfere together. But this has been all the more true since we have found ourselves, after the liberation of our port in September, 1944, in front of extensive destruction and the necessity to restore it as quickly as possible to its rank of a great international harbour. On one hand, never had there been such a mass of work to be done at the same time, when the means available were so poor; on the other hand, if the destruction of so many harbour works brought difficult rebuilding problems, we could also seize the opportunity of changing their former design and adapting them to newer conditions of exploitation.

The Port of Havre after the war was the most badly damaged port on the continent; the destruction was partly the result of 117 allied air raids, but was chiefly due to the work of German demolition squads. Mines were sprung every 25 metres along the 3,100 metres length of tidal quays; the sabotage of lock-gates, letting the tide flow freely in and out of the inner basins, caused a further 2,000 metres of quays to slip down into the docks and most of the other quays were cut with breaches. Some 300 wrecks lay in the port. The three Maritime Stations had been blown to pieces, and so had two-thirds of the public warehouses, and more than the half the transit sheds. Those cranes which the Germans had not removed were included in the chaos; only one little floating

Fig. 1.

crane, of 1 ton capacity, remained available. The dry-docks were badly damaged, including the great No. 7 dry-dock, 313 metres in length, whose floating gate had been sunk in the entrance. (Fig. 1.)

Clearing Work

The first work to be done was to clear from the port the ruins of the sheds and some 300 blockhouses laid by the Germans, to re-establish roads, to lift and cut out the wrecks. This work, and the repairing of those quays which suffered only localised breaches, if it has been very expensive and has met with some difficulties, has been, however, of no special interest since it has called only for primitive technique.

Reconstitution of Cranes

As this is a very specialised matter, I shall only mention the fact, very important for quay-rebuilding and other works, that the Port Authority had in May, 1946, purchased in Holland a floating sheerlegs of 200 tons capacity; a further 125 tons floating sheerlegs, purchased in November, 1947, also from Holland, has been assigned especially to quay-rebuilding work. A 100 ton floating crane, which is being assembled from elements imported from the U.S.A., will be available by the end of this year (1948).

Reconstruction of Mobile Bridges

Nine mobile bridges had been destroyed. Modifications of the general design of the harbour make the reconstruction of three of

Port of Le Havre—continued

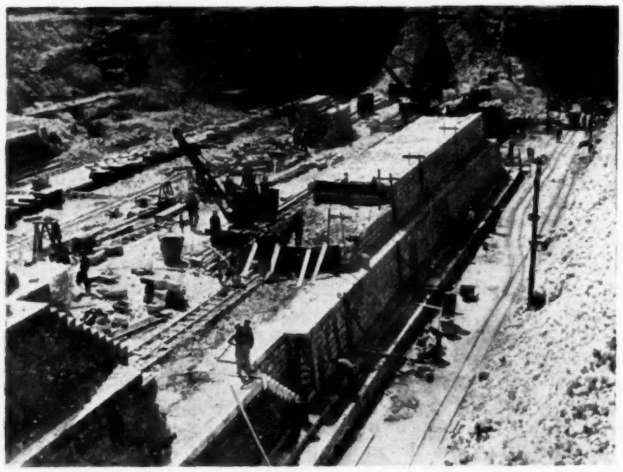


Fig. 2.

Fig. 4.

them unnecessary; four others, big bascule bridges of the Scherzer type, of which some parts had subsisted, have been rebuilt as they were previously. For some swing-bridges which, what with old age and war damage, are to be replaced shortly, we are now studying an all-welded structure, with multiple compound girders underneath a 9 metres-wide causeway and cantilever side-walks.

Reconstruction of Dry-docks

Whereas the three little dry-docks (Nos. 1 to 3; length 65 to 80 metres) remained almost uninjured, and the repair of No. 4 (185 metres) was easy, the repair of No. 5 (165 m.) and No. 6 (140 m.) met with difficulties, as it appeared necessary to clear away the masonry of the walls down to the discharge culverts, which had acted as expansion joints; the docks being founded on a fairly permeable gravel layer, there was much pumping to keep the workings out of water, and the floor had to be loaded with rubble to make up for the temporary absence of the walls. (Fig. 2.)

As for the big No. 7 dry-dock, the only great difficulty was in removing the old caisson, sunk in the entrance, which took twenty months; a new caisson was then put in place, which, as well as the one of dry-dock No. 6, has been supplied by Messrs. Vickers-Armstrong and is of all-welded structure. (Fig. 3.) Fig. 4 shows the reconstructed dock.

Reconstruction of Sheds

A somewhat new design has been carried out for the new shed on Joannès-Couvert Quay; the structure of the trusses, which consists of two spans of 24.80 metres and one of 18.60 metres, is an isostatic one, with simply-supported beams hinged on cantilever beams built-in with the columns. Those simple-supported beams, as well as secondary beams, have been made in the following way: the web of a double Tee steel girder is flame-cut along a zig-zag line, then the two halves are shifted along one another so that convex parts come opposite each other and then are welded together; this process giving a 754 mm. high section (about 30″) from an original 18″ (450 mm.) high girder, has enabled us to gain considerably the inertiæ with moderate weights. (Fig. 5.)

In order to ascertain that secondary strains did not appear, especially under the influence of shear, one of these secondary beams was the subject of an experiment and fitted with Huggenberger dilatometers and electrical-resistance strain-gauges, and then submitted to bending tests. No such secondary strains have appeared, and the beam was destroyed under a load $4\frac{1}{2}$ times the normal one, through buckling of the compressed upper flange, just as a full-section I-beam would have done.

For many of the sheds now to be rebuilt, we are contemplating having reinforced-concrete structures, especially thin-shell ones, on account of their fireproofness, of the great spans that can be obtained cheaply, and also of the attractive ways of lighting the shed.

A new reinforced-concrete shed has just been completed, based on designs presenting still great similarities to steel-framed structures, and consists of 25 metres span portals (82 feet) spaced 14 metres apart (47 feet) and cast in situ; the secondary beams con-

Fig. 3.

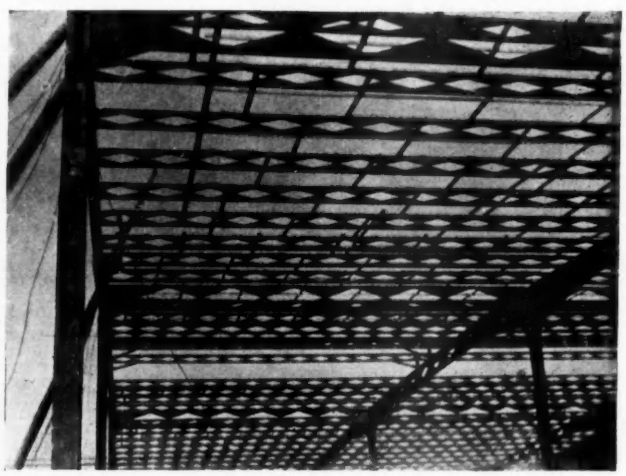
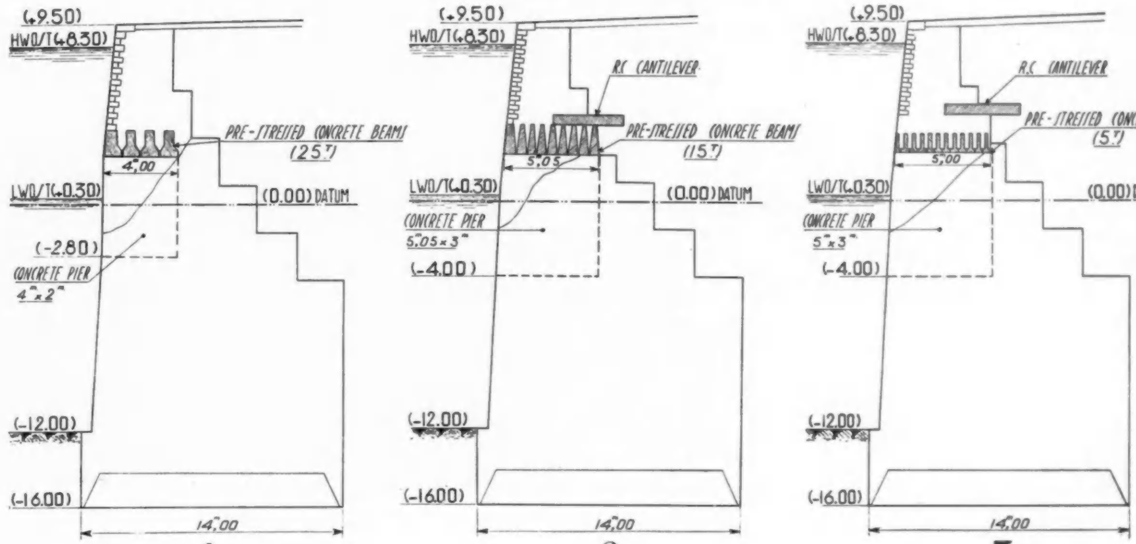


Fig. 5.

Port of Le Havre—continued



Reconstruction of Joannès Couvert Quay (full section part) with Pre-stressed Concrete Beams.—(1) 25 tons each in weight at first; (2) then 15 tons each; (3) and finally 5 tons each.

sist of precast-concrete Warren type lattice girders gudgeonpinned to the main portals. Roofing consists of 2 cm. ($\frac{3}{4}$ inch) thick concrete slabs, each supporting a plasterboard, the intermediate air-spacing thus allowing excellent thermal insulation.

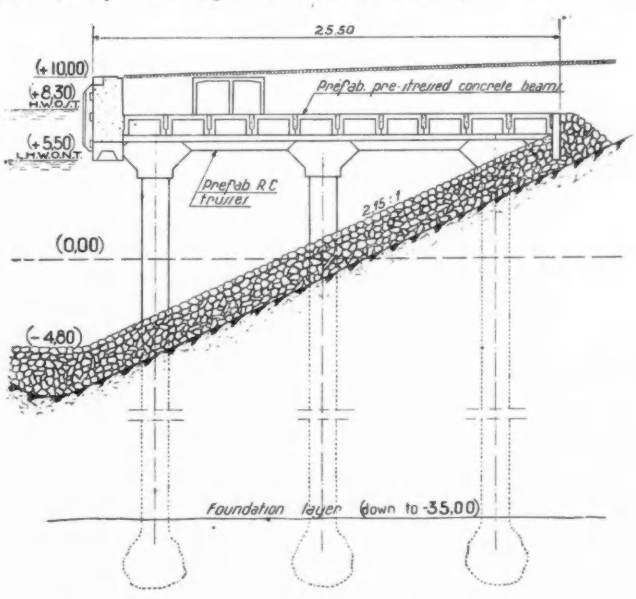
The construction of four sheds with a cylindrical shell structure is now beginning, two of them with one 20 metres span (66 feet), the two others with 2 spans of 17.50 metres (58 feet).

. . . .

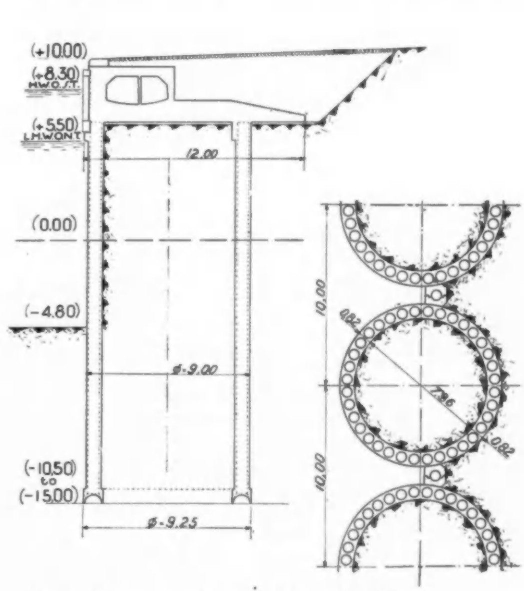
I come now to the main aspect of our reconstruction activity, the one which has brought upon us the most difficult problems (to be solved by new technical methods), I mean the reconstruction of the quays.

Reconstruction of Quays

Tidal quays in the Port of Havre are very large works since, H.W.O.S.T. being at (+8.30m.) and L.W.O.S.T. at (+0.30m.) above datum, they are dredged 12m. under datum (with the exception of the oldest one, Escale Quay, which is dredged only 9.50m. under datum), and have their foundation 17 to 20 metres under datum, while their coping is 9.50 or 10 metres above it. Those which were heavy full section walls, i.e., the Escale Quay and the first-built, 500m. long, part of Joannès-Couvert Quay, have comparatively well resisted, only the upper part of them being blown away; repair work had yet to be done up from an average depth of 4 metres under datum. The other parts of Joannès-Couvert Quay, i.e., a 500m. long part made of arches, 25m. in span, resting on pillars driven to the foundation layer, with a rubble slope under them and a retaining wall behind—and a 175m.-long part made of concrete caissons driven down with help of compressed air—have been much more severely damaged, and only the lowest stump of them will be used in the rebuilding. As for the quays of the Compagnie Industrielle Maritime, which were a reinforced-concrete work of very neat design, with a light plat-



Type of quay used on a 1,200 metre length
(Quay on 1.50m. dia. piles, built by the Benoto process).



Type of quay used on a 300 metre length
(Quay on cylindrical piers).

Reconstruction of a Quay, 1,500 metres long, in the Inner Basins.

Port of Le Havre—continued

form on piles driven through a rubble slope, and massive dolphins in front, they have been completely blown away.

To this we must add 2,000m. of quays in the inner basins, which, as we previously said, slipped down when the tide had access through the sabotage of lock-gates, and the ruins of which are to be cut away with the help of a new powerful dipper-dredger we have received at the end of September from the Lobnitz works in Renfrew.

So we were faced with two different sorts of work: in the first place to repair those quays, a small part of which at least remained to be used, i.e., the two full-section quays, and then the remainder of Joannès-Couvert Quay (part on arches and part on caissons); and secondly to build entirely new quays where the old ones had been completely ruined, that is the quays of the C.I.M. and those in the inner basins. For those new quays, it was decided to take the opportunity and give them better alignments: three quays, separated by moles, on the southern side of the inner basins, are to be replaced by one straight-line quay, 1,500 metres in length, with high-efficiency equipment and no hindrance to ship traffic; in the same way, instead of the previous design of the C.I.M. quays, which allowed for too little ground area, a new alignment

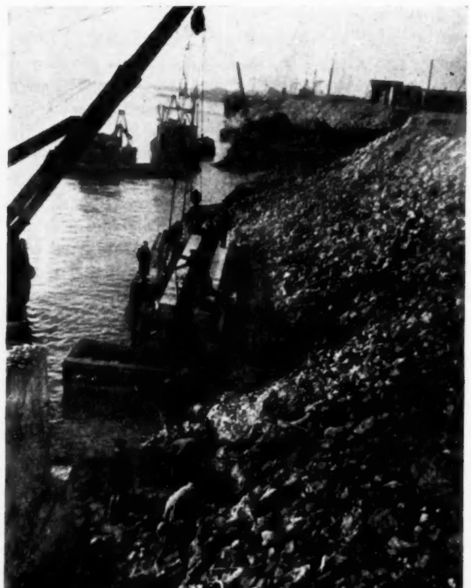


Fig. 6.

will be carried out, nearly in line with Joannès-Couvert Quay (this design has another advantage, since it avoids clearing most of the ruins of the old works, embodied in the reclamation area behind the new quay).

Reconstruction of Full-Section Quay Walls

At some places, intact masonry did appear above low-water level, and the refection of the quay wall was very easy. But in most places it did not; so it was decided to construct rectangular piers, settled in the old wall by means of compressed-air caissons driven down through the demolition rubble and split masonry until they met an entirely sound base. On those piers, driven every 11.66m. (i.e., three of them on the 35m.-length of the caissons on which the quay had been built, in order to miss their joints), prefabricated beams would be set at the height of (+2.50m.) above datum, that is the minimum height at which normal tidal work is to be done, forming a sort of viaduct on which the upper part of the wall could be rebuilt.

The difficulty was to have beams which, for the given span and load, would be easy to handle, not too heavy in respect of the means available, and at the same time not too numerous, so that

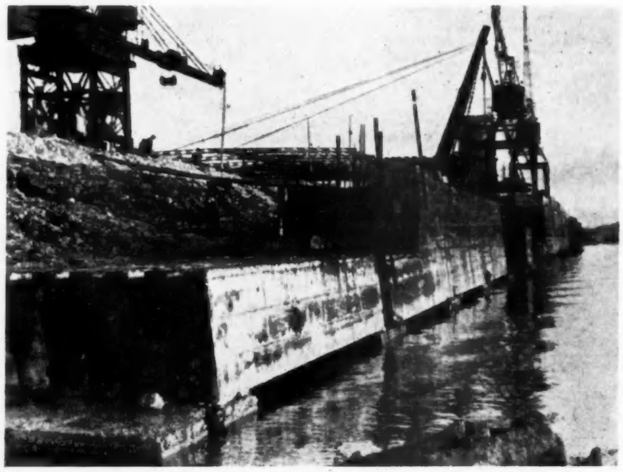


Fig. 7.

the setting of one span-width should be easily completed in the time of one low-tide. As this was not to be obtained with normal reinforced-concrete beams, we used pre-stressed concrete. These pre-stressed beams were made according to the well-known Freyssinet system, in which, after the setting of the concrete, high-resistance steel cables are stretched by means of special hydraulic jacks, which then anchor the cables by forcing into position conic wedges of coiled concrete which holds the wires of the cables.

Experience gained in the reconstruction of Joannès-Couvert Quay, which was begun first and the 500m.-length of which was completed last June, led to a very satisfactory solution: twelve beams side by side on the 5m.-breadth of the piers, each of them having a weight of 5 tons, were easily and quickly set in place by means of a land crane. (Fig. 6 and 7.)

For the Escale Quay, on the contrary, a single pre-stressed beam, in the shape of a box, with a weight of 120 tons, covers the whole span; the placing of it into position necessitated the use of one of our two big floating sheerlegs, but the operation is very easy and quickly done. (Fig. 8.)

So these two quite opposite solutions have proved equally successful, whereas intermediary ones, which were used at first on Joannès-Couvert Quay, have given far less satisfaction.

While piers, at Joannès-Couvert Quay, were made by means of mobile steel caissons, those at Escale Quay are reinforced-concrete caissons left in the ground, the total height of each one being chosen according to the approximative depth it is expected to reach.

Fig. 8.

Port of Le Havre—continued

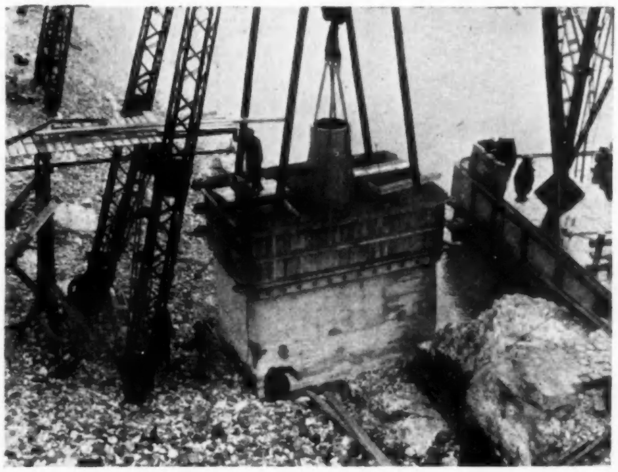


Fig. 9.

This second method has the advantage that it saves the time of building the pier which, by the way, is prefabricated. (Fig. 9.)

A difficulty has been met in most parts of Escale Quay, which had been but locally encountered in Joannès-Couvert Quay: subsisting masonry is too low at the rear part, so that there remains a gap between it and the flooring; special reinforced-concrete caissons are driven down to close this gap.

Escale Quay will be completely restored by the end of the spring next year (1949).

I should still mention the use, for the facing of the upper walls of those quays, as much as for other masonry works in the port, of concrete ashlars; those ashlars, a great number of which have been fabricated at a low price and stored, need only inexperienced masons; they serve as a cofferdam for concreting, being laid in place with quick mortar at the preceding low tide.

Located as it is in front of the entrance of the Outer Harbour, Escale Quay is the only quay in the harbour to suffer from swell when a fresh norwester or west wind is blowing. As we now rebuild this quay, we are fitting it out with shock-absorbers, that will overcome all inconveniences to shipping; those shock-absorbers are of the type already in use before the war at Le Verdon on the entrance of the Gironde, some of them have even been recuperated from there, where the destruction of the pier made them useless; they consist of a massive azobe structure, acting as a fender, which is hinged at its upper part and swings between two reinforced-concrete flanges built-in with the quay wall, and is connected through a rod to a powerful oleo-brake, able to absorb the shock of a 20,000 ton ship at 0.40m/sec.

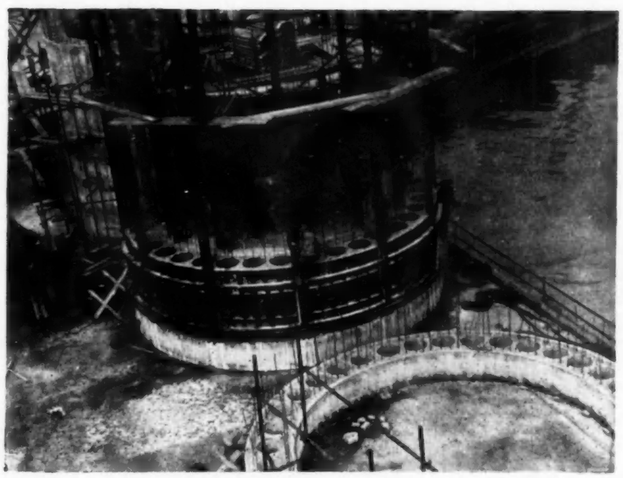


Fig. 10.

Reconstruction of the " 175 Metres Quay "

This quay, built of concrete caissons, is part of the great Joannès-Couvert Quay; it had been shaken not only by mines, but also by the explosion of a nearby torpedo store; the caissons were broken just above the bottom of the basin, leaving only their bases unmoved. It was on these stumps which on the other hand would have been very difficult to eliminate, that we were to rebuild the quay. We have imagined to stack upon it a series of 3 reinforced-concrete boxes, reaching to (+2.50m.), to fill them with concrete, and then to build upon it a massive superstructure, making a hammer-like section of wall.

The problem to solve is then essentially one of concreting under the sea in great mass, and making good concrete. We have already done the concreting of a 40m.-length of quay; concrete was brought to the site by pumping, and then passed down a vertical spout, 30cm. in diameter; special care was taken when starting, in order to form around the base of the spout a bulb of unwashed concrete that would protect further concrete from being washed out. This was obtained by the use of a wooden stopper with a linen skirt behind it, retained by a steel cable at the upper end of the spout. This stopper was lowered progressively, in order to avoid every

Fig. 11.

rough movement of water inside the spout, under the pressure of concrete, and dropped only after the spout and the funnel above it were full of concrete.

Although this first attempt has not been unsuccessful, we are studying a way of reducing the washability of concrete, by making use of the special properties of " colgrout," i.e., a colloidal mortar, of little miscibility with water. The injection of colgrout into aggregates has been proved by recent experiments to be especially good and to give remarkably tight concrete. So, for the concreting of further boxes, we are contemplating to fill them first with stones and then inject colgrout. This seems to be a process of general interest for under-water concreting.

Reconstruction of the Vaulted Quay

This quay, a 500m.-long part of Joannès-Couvert Quay, will be rebuilt on a composite design resting partially on the remainders of the pillars and of the retaining-wall, mobile compressed-air caissons are now used to ascertain their condition. This survey has brought to light an interesting fact concerning the durability of concrete in salt-water. Those works were made of puzzolanic cement, which is said to have a good chemical stability in salt-water; yet large blocks of concrete burst open by the dynamic effect of explosions, and ultimately in contact with sea water for the last four years, are now showing advanced chemical decom-

Port of Le Havre—continued

position, with more than 10% magnesium sulfide in them, and quite as much sodium chloride. The only conclusion from this can be that concrete will resist only through its imperviousness.

Construction of a 1,500m.-long New Quay in the Inner Basins

We have already said how it was decided to substitute this new straight-line quay for the design of previous works; we must add, it will also be notably deeper, giving a minimum of 10m. draught at Neaps.

The construction of a first type of quay has begun on the western part of it, about 325m. long; it consists of reinforced concrete cylinders, 9.00m. in external diameter and 0.82m. thick. Those cylinders are driven down with the help of very heavy "Benoto" grabs 50cm. in diameter called "hammer-grab," which work by hammering. The grabs are dropped through holes, 60cm. in diameter, in the thickness of the cylinders, and so take the ground away from under them, while the central nucleus remains intact, adding stability and sparing useless earth-moving. Descent of the cylinders is easily controlled through the combined action of the four grabs working on each. This design could find no appliance for lower foundations, the economy in it disappearing then. (Fig. 10.)

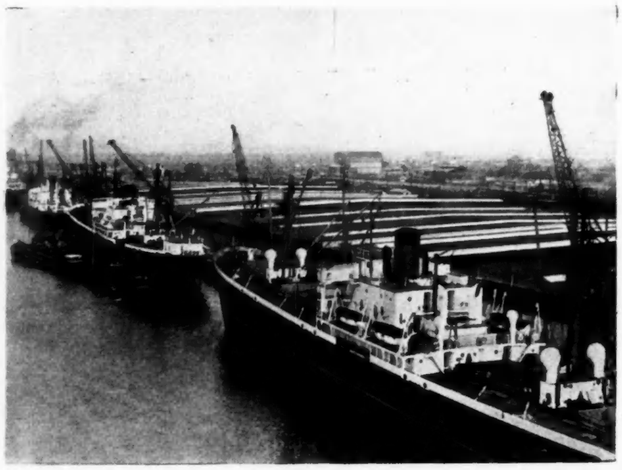


Fig. 12.

The remaining 1,200m. will be built according to another type of quay, well adapted to reaching very deep foundation layers, as the borings have proved them to be on a great part of the distance (35 to 45m. under the ground-level). It rests on concrete columns, 1.50m. in diameter, resting themselves on the foundation-layer, and which are made in the following way: a sheet-iron pipe, of 1.50m. in diameter, is driven down with the help of a 1.35m. diameter "Hammergrab," the soil frictions being annihilated by an alternative rotation of the pipe. When the pipe has been driven down, concreting then takes place and the tube is pulled back. Here also, experimentation of concreting through injection of colgrout into the aggregates already put in the tube, has given very good results. (Fig. 11.)

On the columns rest semi-prefabricated transverse trusses, supporting a flooring made of pre-stressed beams.

A similar structure is being studied for the construction of the new quay, in approximative alignment with Joannès-Couvert Quay, which will be substituted for the previous design of the C.I.M. quays.

So much may local conditions have determined the work done in our port, yet there are some aspects of which more general application could be made; I would mention the use of the many prefabricated parts and the adaptation of pre-stressing to them; our experiments for under-water concreting; the use of "Benoto" plant for boring and foundation work. I should also mention the fact that the Port's Laboratory is now equipped with apparatus, and in particular Casagrande's shearing machine, for testing the numerous soil-samples bored out at every point of the new works.

Conclusion

In conclusion I should like to draw your attention to the extent of the reconstruction programme of the Port of Le Havre. This programme now 50% completed represents, under present prices, an expenditure equivalent to more than 30 million pounds sterling; however, this expenditure is being now comfortably repaid through the income which is derived from the important traffic in the harbour and which incidentally has now achieved an efficiency far beyond the volume of pre-war days. (Fig. 12.)

DISCUSSION.

In the discussion that followed the presentation of the Paper, **The Chairman** said that he would like to draw particular attention to the big cylindrical caissons used, with vertical holes of something like 24-in. diameter cast in the annular wall of concrete. When he had seen them at Le Havre he had been intrigued with them, and had expressed a doubt to M. Billotey as to whether they would work, but M. Billotey had assured him that they would. They had tried them at La Rochelle through a stratum consisting of sand and clay and the results there had encouraged them to go on. Perhaps M. Callet could give further information about them, because they were of great interest to English engineers.

M. P. Callet said that the caissons in question had not been used at Le Havre but had been used with success at La Rochelle. They went down by their own weight into the stratum before the ground had had time to close in. If any obstruction was met with, the difficulty could be overcome by increasing the weight on the caisson. If there were difficulties caused by boulders or some other obstruction, they could always be overcome by excavation.

Mr. F. E. Wentworth Sheilds, O.B.E., Past President Inst.C.E., said that he had been very interested in the photographs shown of the shock absorber. It would be within the recollection of many members that there had been a paper by Professor Baker of the Imperial College on a shock absorber built on a jetty exposed to violent wave action. The principle of it was that the ship gradually displaced an enormous weight, which weight eventually restored the position of the shock absorber to its original position when the ship had passed on. The shock absorber mentioned by the author was, he understood, worked on the principle that the ship when coming to rest had practically to move a piston through a resistance of oil, but he was not quite clear as to how restoration to the original position was effected. It seemed to be a very ingenious idea.

M. Callet replied that it was the shock absorber's own weight which brought it back into position. As explained in the paper, such fenders had been used at Le Verdon for a number of years most successfully.

Mr. D. H. Little asked whether the shock absorbers had any resistance longitudinally or only at right angles to the jetty.

M. P. Callet replied that the longitudinal strain was taken by two buttresses of heavy reinforced concrete. They were calculated to take the required strain.

Mr. D. H. Little asked whether there was any absorption in the buttresses.

M. P. Callet replied that the strain was transmitted through friction without shock on the buttresses. There were two on each fender and the fender slid between them. There was no shock, or properly speaking the shock was spread over. The end of the shock absorbers was made of azobe, which was a special Colonial timber, which formed the fender. There was therefore no definite shock on the concrete buttresses but a relatively slow effect.

Mr. V. A. M. Robertson, C.B.E., M.I.C.E., said that he had had the privilege some time ago of being in Le Havre and he had been very interested in the problem from the point of view of manpower. Perhaps the author could say just how he got his labour in France. Assuming an expenditure of £12,000,000 during the past year and assuming that two-thirds of that represented labour, it meant about £800 per man or 10,000 men. Had the port authorities got 10,000 men and, if so, how did they get them in France?

M. Callet replied that the number of men employed was 7,000. They were all Frenchmen, some of whom came from the imme-

***Port of Le Havre**—continued*

diate neighbourhood of the port, but the majority came from the regions round Paris.

Professor A. L. Baker asked whether rake pile construction was considered for many parts of the new berths. In England it had been found that on many sites that piling was cheaper than caissons. He wondered if there was any particular reason why raking pile construction had not been used. Was it not practical or not so economic as construction with pre-cast concrete and so on?

M. P. Callet said that the Quay du Rhin which was on the Havre to Tancarville Canal was constructed in that way, but the reason why they had not been used in most cases was that the length of the piles would have to be **40** metres (**130-ft.**). That was why raking construction was precluded. Cylindrical **1.50m.** diam. piers used for the new quay in the inner basins could be driven in with simple equipment at the rate of two every three days.

Mr. H. Kaylor remarked that he had been very interested in hearing about the use of pre-stressed concrete in the reconstruction of modern quays and also in the construction of concrete beams. He had understood that the beams were cast upside down and he wondered what advantage there was in casting them unside down.

M. Callet replied that it was found easier to cast the beam upside down with the smaller part of the trapezium downwards.

Mr. Kaylor said that he had thought it was perhaps a question of getting the stronger concrete at the bottom so that it would be stronger at the top afterwards.

M. Callet replied that that was not so. It was simply easier to concrete that way.

A Member asked whether there had been any difficulty in making the original survey before the reconstruction work was started. Were any particular methods used in plotting the particular points in the piers considered solid? Also, how had they cleared the rubble under water to find out where the stronger foundations were situated?

M. Callet said that they had used compressed air in order to get down to the foundation level and ascertain the solidarity of the buried masonry. There had been no difficulty in the survey of the whole of the harbour.

American Rivers and Harbours

Legislation to Improve Navigation and Port Facilities

The **39th** Convention of the National Rivers and Harbours Congress was held in Washington, D.C., on the **8th** and **9th** April, **1949**, when a number of Reports and Papers were presented and discussed. On the opening day, a message from President Truman was read, in which he pointed out the need for developing and conserving the natural resources of the United States of America, so as to make the economy of the country strong and healthy. Members of the National Rivers and Harbours Congress are engaged in an important phase of that work, and for almost half a century have guided the development of the country's water and land resources, aiding in the vital work of flood prevention, irrigation, reforestation and the creation of electric power.

The subject of inland navigation is one of world-wide importance, and a number of the questions and arguments discussed at the Congress are equally appropriate to many countries besides the United States of America. The following points taken from a number of the reports and addresses will therefore be of general interest.

Extracts from an Address by Chester C. Thompson, President of the American Waterways Operators, Inc.

The outlook for continued development of inland waterway transportation in the United States was never more favourable. It has grown by leaps and bounds, particularly during the past two decades, and is now permanently established as a vital element of the transportation and distribution economies of the Nation.

For many years water transportation was regarded as a nuisance in the transportation business of the country. The all-important services provided by it during the war years **1941-1945** dispelled that idea for ever. Water transportation is cheap transportation; it has little to fear in the matter of competitive costs. The Barge and Towing Vessel Industry is progressive and constructive and, by technical developments, has kept abreast of the growing demand for water transport services.

If water transportation had not been sound and essential to the economy of the country, it would have been liquidated long ago. No single type of business has ever been subject to more vicious, unfair, and unwarranted attacks than has domestic water transportation. It had to have something worthwhile to survive these attacks, instigated by the railroads and their supporting and sympathetic groups and organisations.

Water Carriers were attacked in the Congress, in State Legislatures, local City Councils, by the Press, and through every other possible means. The restrictive legislation proposed for it, if enacted, would so "hamstring" the industry that it could not possibly function for the benefit of shippers and in the public interest. These attacks continue; they continue before the regulatory Agencies of Government, before civic groups not actually familiar with the importance of water freight services, and in every place where it might be possible to prejudice the general public against low cost water transportation.

The Domestic Water Carriers and Operators—the Barge and Towing Vessel Industry—are grateful for the support and assistance long given them by the National Rivers and Harbours Congress. Surely every form of transport has its rightful place in the economic scheme of things, and each should be permitted to do that job of transportation for which it is best equipped.

Water transportation is not a "cure-all" for all of the evils of the ever-changing economy of the Nation. There are some transportation jobs it cannot efficiently do, but it can and does do much which is beneficial and helpful to business, commerce and industry. Consumers pay less when producers enjoy lower water freight rates on their raw materials. Farmers are paid more for their grain, when it is possible to ship that commodity by water from the local elevators to the central markets and to ports of export. Electricity as well as heating and cooking gas are cheaper in many communities where the utility companies receive their coal at low cost water freight rates. Literally hundreds of other instances can be cited, which definitely show water transportation to be in the interest of the general public.

As further proof, attention is called to the location of many new industries at sites where water transportation is available. New plants have been and are being built at hundreds of places on the Mississippi River System, the Gulf Intracoastal Waterway, the Atlantic Intracoastal Waterway, and on the Columbia and other rivers.

Well over **500**-million tons of freight were moved on the improved navigable inland waterways of the United States in **1948**. The ton-miles of this traffic are estimated at **33½** billion, and there is no doubt that this tonnage will be substantially surpassed in the present year of **1949**. Any system which is the means of moving one-half billion tons of freight in one year, and of moving that large volume more cheaply than it could have been transported otherwise, is definitely a public service.

Abridged Report of the Resolutions Committee

The rate of development of the country's water resources and the removal of flood threats which hamper the people in their efforts to develop the latent wealth of the Nation are, in turn, contingent upon federal appropriations. Flood control and improvements for navigation, irrigation, power development, soil erosion, and allied purposes are not matters to be put off pending a recession or depression. On the contrary, such improvements should be made as rapidly as possible so as to contribute their part toward continued prosperity and a high standard of living in America. For these reasons, it is urged that the Bureau of the

American Rivers and Harbours—continued

Budget and the Congress give full and careful consideration to the recommendations of the agencies charged with the development of the country's water resources and that they approve and appropriate adequate funds to prosecute these improvements at an optimum rate.

Soil Conservation.

The Committee believe that the prevention of soil erosion is a responsibility of the Department of Agriculture and the closely related major drainage and channel improvement programme now conducted by the Corps of Engineers should be accelerated as a beneficial and most important feature in the development and preservation of natural resources.

Department of the Interior.

The Bureau of Reclamation of the Department of the Interior is to be commended for the progress it has made in reclaiming the arid and semi-arid land in the seventeen western states. There is increasing need there for additional Federal projects for irrigation to bring all cultivable lands for which water is available into production for the increasing population of the Western states and to meet commitments abroad. Adequate funds to provide the many facilities for the varied irrigation needs must be available in consistent annual amounts to enable rapid progress to be made.

Hydroelectric Power.

In promoting the orderly development of the land and water resources, the National Rivers and Harbours Congress has been steadfast in its position that hydroelectric power development at Federal dams should be economically justified and consistent with the necessity for such power. Such development should be confined, however, to projects located in shortage areas and then only when feasible and as a supplement to existing private supply. Supplemental power from steam plants is questioned as being inconsistent with the policy adhered to by this Congress, as is the construction and operation by the Government of transmission and distribution systems. Unrestricted and unwarranted competition with private power facilities will continue to be opposed.

Stream Pollution.

The National Rivers and Harbours Congress recognises the Water Pollution Control Act of 1948 to be an important factor in the relief of its concern of many years with the pollution of streams. Therein is contained provisions for the elimination of many of the complications heretofore involved in the division of State and Federal jurisdiction which have been a retarding factor in reaching a satisfactory solution of the matter and in promulgating enforceable regulations. The Congress is urged to provide the authorised funds as rapidly as economically required by the existing agencies for the elimination of this menace to the Nation's health and to the wildlife population of the country.

Federal Barge Line.

The pioneer work of the Federal Barge Line in developing inland water transportation has been of great benefit to private operators and can continue to be of inestimable value for some time to come. Much remains to be done, however, in the development of carload and smaller shipments and modern terminals available to all shippers. It is strongly urged that no part of its operations be discontinued or disposed of until private operators are able to carry on their own pioneering and are equipped to provide service identical to that now provided by the Federal Barge Line.

Tide Lands.

The title to the submerged lands of the nation should be vested in the States through adequate legislation designed to reserve such submerged lands and the resources therein to the respective States and their people. However, any legislation for this purpose should preserve to the United States the paramount right to continue with improvements for national defence, navigation, flood control, and allied purposes as now authorised and as may be authorised in the future.

Re-organisation.

Economy and efficiency in government are desirable. The Committee do not believe, however, that grouping the major construction activities of the nation, including the Civil functions of the Corps of Engineers, in one agency will accomplish this. On the contrary, they believe that the recommendation of the Hoover Commission to consolidate these functions in the Department of Interior would produce the opposite effect. This agency, under this proposal, could have as its head an officer with an abundance of power, almost dictatorial. His influence could extend throughout the Executive Branch and unchallenged could possibly extend even to the Congress itself. The potential patronage and favouritism in one large group, such as the one contemplated, could easily sway the people in all the States to make demands on Congress far in excess of their requirements for orderly development of their civil works programmes. Such a situation would certainly create costly bureaucracy and could not result in saving money.

American Merchant Marine.

The national security and a strong national defence require a modern, efficient Merchant Marine, built and operated by private enterprise with Government aid to the extent necessary, and supported by public patronage. A progressive shipbuilding programme is needed to provide a modern, well balanced merchant fleet of vessels of all types.

To induce private capital to undertake these responsibilities, favourable economic conditions must exist. It is in the best interest of all sections of the Nation, and particularly the seacoast communities and ports, to actively support such a Merchant Marine as a continuing national policy so as to avoid dependence upon foreign controlled shipping.

The New Chief of Engineers.

Like his predecessors, Major General Lewis A. Pick has been selected from a group of experienced engineer officers to direct the activities of the Corps of Engineers for the next four years. His ability to get things done has already been amply demonstrated and the Committee are happy to have General Pick carry on the century-old traditions of the Corps of Engineers and are confident that he will continue in the splendid manner in which those who have served before him have done.

Excerpts from Address by Major General Lewis A. Pick, Chief of Engineers

It has long been the custom for the Chief of Engineers to come before the National Rivers and Harbours Congress each year and present an outline, as it were, of the river and harbour and flood control work assigned to the Corps of Engineers by the Congress of the United States. Consequently, in this, my first appearance before you, as Chief of Engineers, I follow a precedent maintained by many distinguished predecessors. It is a circumstance which I appreciate fully. Yet I hardly need to assure you that I shall give to this office the utmost of my ability to maintain those traditions of the Corps which have become by-words among the American people—non-partisan public service, high engineering efficiency, proper administrative economy, and unswerving devotion to the national welfare.

I hope, in turn, that your nation-wide organisation will continue its fine co-operation with the Corps of Engineers in our extensive civil works programmes.

For many years the National Rivers and Harbours Congress and the Corps of Engineers have had a common bond in a common objective—the improvement of our waterways and harbours for navigation, commerce and flood control.

Our earliest responsibilities were in the field of water-borne transportation. In normal peacetime economy, waterways have

American Rivers and Harbours—continued

always played an important part. In emergencies of war they have been vital. To meet heavy and immediate demands, our waterways are unexcelled. They are capable of any expansion to relieve overtaxed carriers of rail and highway.

The records of national progress lend emphasis to the importance of the inland shipping industry. Of 95 cities listed in the 1940 census with populations greater than 100,000, sixty-two are on navigable channels improved by the Federal Government. And our major industrial centres are located where they can take advantage of water transportation.

By the close of the current fiscal year, the record of accomplishment of the Corps of Engineers in the improvement of rivers and harbours in the interest of navigation will include as completed projects 190 harbours, 400 locks and dams, and 27,000 miles of improved inland channels.

But rivers and harbours work is a continuing job. To get the greatest value for our transportation dollar, the people must improve their waterways to the fullest practicable extent. No one from those regions need to be reminded of the economic progress to be encouraged by increased improvement of the Red, the Arkansas, the Missouri and similar streams in the United States. Then, again, there is the need for keeping our improvements attuned to the trend toward larger vessels and greater tow lengths —with 2,000 horsepower towboats moving 14,000 tons of cargo in a single trip.

Among projects waiting to be undertaken are the further improvement of the Mississippi River system's waterways; the completion of our intracoastal waterways; the construction of navigation feeders into inland areas off the Gulf of Mexico; the completion of the Sacramento River project; the completion of the projected improvement of the Columbia and Snake Rivers in the Northwest, and many others. All of them will contribute greatly to the progress of their respective regions and, consequently, to the economy of the nation, as a whole.

During the war years, the maintenance of our important waterways and navigation structures fell far behind. This was due to critical shortages of man-power, materials and equipment. The post-war resumption of maintenance has been on a limited scale to conserve the materials and equipment needed by industry for the country's quick conversion to a peace-time economy.

The result has been a large accumulated backlog of such work. In addition to maintenance dredging, there are breakwater repairs needed at many of our coastal harbours. And the badly-worn machinery and facilities of older structures in our canalised waterways should be replaced.

We are currently engaged in the construction of 79 river and harbour projects, 23 of which will be completed this year. The President has recommended the appropriation of funds sufficient for construction work on 67 river and harbour projects during the 1950 fiscal year and for maintenance and operations.

Federal flood control on a nation-wide basis is still in its infancy. The first act for Flood Control, General was passed in 1936. The first appropriation act pursuant to the authorisation of this 1936 legislation was made for the fiscal year 1938—only eleven years ago. We lost four working years of this short period during the war. Yet, by the end of the fiscal year 1948, the Corps of Engineers had completed 172 local protection projects and 56 reservoirs. The cost of these projects amounted to 483 million dollars. And I am happy to report that the estimated value of flood damages already prevented by these works exceeds 500 million dollars. By the close of the current fiscal year we will have increased the total of completed projects to 60 reservoirs and 201 local protection works.

The 1950 programme for Flood Control, General—as contained in the President's budget—provides for the continuation of work on 156 projects, 60 of which will be completed during the fiscal year. In addition, the programme provides for the initiation of two projects—one in Illinois and one in Southern Florida. It is estimated that the projects included in this programme will provide average annual flood control and other benefits in excess of $260,000,000.

Major elements of the general flood control programme are the comprehensive river basin plans of improvement, authorised in the Flood Control Act of 1938.

At the present time, Congress has authorised 15 of these comprehensive plans. They include the Connecticut, Ohio, Missouri, Upper Mississippi, Arkansas, Rio Grande and Williamette river basins. They also include programmes for Central and Southern Florida, and for the Los Angeles River in California. Congress has further recognised the importance of these basin plans in Flood Control Acts subsequent to 1938, by increasing monetary authorisations until the authorised expenditure for partial accomplishment now totals $1,507,000,000. This is 60% of the total monetary authorisation for general flood control.

The comprehensive river basin plans are actually a programme for the control and use of flood waters, and for conservation of the water resources of the nation. Congress has specifically directed that the Corps of Engineers—in reporting on projects for flood control and other purposes—must consider related water problems and uses—such as navigation, power development, water supply, recreation, preservation of fish and wild life and abatement of pollution.

In many cases, dams required for flood control also afford opportunity for development of economical hydroelectric power. To leave this major water use undeveloped would be grossly inefficient and wasteful. Moreover, it would not be in accordance with Congressional directive.

To date, we have in operation three multiple-purpose flood control projects, with an installed capacity of 106,000 kilowatts of power. The Dale Hollow Project, in Tennessee, began power production last December. Additional power units are currently being installed at Denison Dam, in Texas and Oklahoma, and at Norfolk Dam, Arkansas. Power installations now authorised by Congress will result in an ultimate installation of about five million kilowatts of power. Since there is a general power shortage throughout the nation, this is an important collateral aspect of the Flood Control Programme.

The drainage problem in the United States is one of great magnitude. Our estimates show that there are almost 24 million acres of undrained potential farmland, and that about 15 million acres of this land can be brought into production—or have its production improved by a combination of drainage and flood control.

In the Flood Control Act of 1944, Congress gave legislative recognition to the fact that channel and major drainage improvements are an essential part of—and complement to—flood control improvements. All studies under river basin planning of the Corps of Engineers recognise this relationship, and certain projects involving major drainage features have already been authorised by Congress.

Recreation is not given economic value in our estimates of benefits to be derived from completed reservoirs. Yet, the recreational needs being served to-day by our completed reservoirs is strikingly reflected in the record of public patronage. By actual count there were more than two million visitors during 1948 at Lake Texoma, which is created by Denison Dam, on the Red River, in Texas and Oklahoma. An estimated ten million persons enjoyed our reservoirs during the year, for boating, swimming, fishing, picnicking, and camping.

As a result of the continuing programme of examinations and surveys, a large number of investigations have been completed since the war. Currently, we have approximately 500 surveys under way, with reports passing through the various stages prior to transmission to Congress. These investigations represent the first step in the solution to remaining flood problems. The plans recommended are comprehensive in scope and involve conservation and use of flood waters as well as control.

Outstanding among these reports is the one recommending a comprehensive programme of control and development for the Columbia River Basin. This plan calls for a total Federal expenditure of three billion dollars. I have prepared my tentative report to Congress on the Columbia Basin plan and have submitted it to the governors of the affected states, and to other Federal agencies, for their comments.

Hydrographic Surveys

A Method of Large Scale Plotting

By D. A. COLLINS, A.M.Inst.T.

A position defined by horizontal sextant angles, and plotted by station pointer, in the manner usual in hydrographic survey, may be defined also as lying at the intersection of two circular arcs which are, respectively the locii of points representing the observed angles. Similar circular arcs may be plotted in the form of a graticule covering any area which it is proposed to survey.

This technique for eliminating the station pointer was in use more than twenty years ago, and the method was included in the instructions to the United States Coast and Geodetic Survey(1), and has been described in its application to harbour work by Bostwick and Rosenzweig(2), and MacMillan(3), (4).

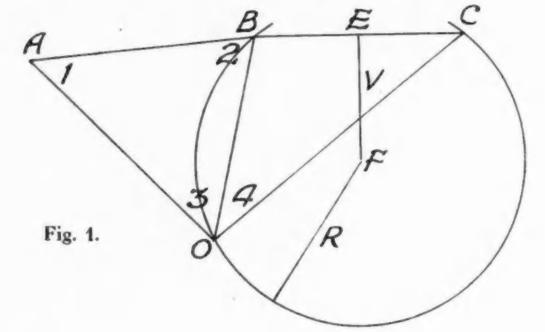


Fig. 1.

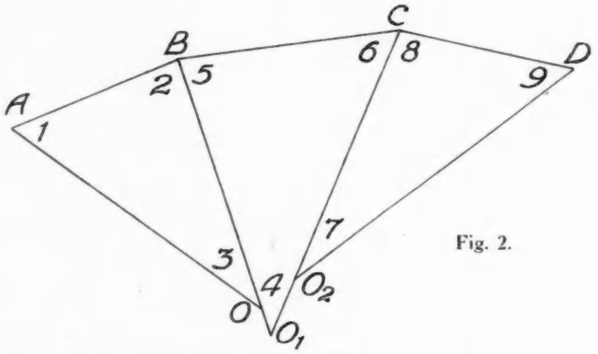


Fig. 2.

The positions of circle centres, and their radii, are found by plane trigonometry. In figure 1, an example of such work is shown. A, B and C are objects observed. O, is the observer's position. The observed angles are denoted by 3 and 4. The centre of the circle corresponding to angle 4, lies at F along the line EF, which bisects BC at right angles.

In figure 1 : V = 1/2 BC. Cot. 4,
and R = 1/2 BC. Cosec. 4,

where V is the distance EF and R is the radius of the circum-circle to the triangle BCO, corresponding to the angle 4.

It is useful to tabulate these expressions for all required values of the observed angle.

An early American method of working, by small scale plot and photographic projection, is very probably still as convenient as any where photographic facilities are readily available. The use of two independent pairs of objects for subtending the observed angles gives the advantage that sounding marks may be so placed on the ground as to give the strongest graticule while reducing computation.

These applications have proved valuable alternatives to station pointer work. There remain, however, cases in which station pointer methods are practically impossible, and it is, unfortunately, in these cases that the old graphical technique for plotting circum-circles, outlined above, is at its weakest. Where, for instance, areas lying at considerable distances offshore are to be surveyed at large scales, and in some cases of large scale inshore work, the graphical plotting of the circular area requires long compass beams with resulting inconvenience and possibility of error.

The proper alternative would be Pothenot or Collins Point solutions for each graticule intersection. This would entail tedious computation, though it would be no hardship in many of the deliberate, routine surveys for which it might be required. A further alternative, where acceptable, would be the computation of a limited number of accurate positions and the joining of these by arcs drawn on railway curves of approximately correct radius. In cases of this kind it would be more satisfactory to compute back to the observed angle from a pre-selected radius for which an accurately cut curve exists.

Thus, in figure 1: $4 = \text{Sin}^{-1} \dfrac{BC}{2R}$ where R is the pre-selected radius.

For other angles the finite variations in sines, may be computed from the radius variations.

The following technique is, however, suggested as a suitable means of accurate working while avoiding the somewhat complex double angle solutions.

In figure 2, A, B, C and D, are objects observed. The distances between them and the angles at B and C are known from the controlling survey. O is the position of the observer. From a small scale plot measure values for the angles 1, 2, 3 and 4. The angles 3 and 4 may be assumed to the nearest convenient integral value, or they may be governed by some pre-selected radii. The value of 5 is now fixed by 2. Conclude a value for 6.

$$\text{Then, in figure 2}: BO = AB \frac{\text{Sin } 1}{\text{Sin } 3}$$

$$\text{and } BO_1 = BC \frac{\text{Sin } 6}{\text{Sin } 4}$$

$$\text{then } O \quad O_1 = BO \quad BO_1.$$

Similarly an intercept such as O_1 O_2 may be found if necessary. These intercepts may now be plotted, at any required scale, independent of the objects A, B, C or D. It now remains necessary to plot any required group of curves corresponding to angles observed.

In figure 3, A and B are objects observed, O is the observer's position. OG is a line parallel with the locus (EF of fig. 1) of circle centres. HJ is a line tangent to the curve locus of the angle at O (observed between A and B). The radius to the curve lies perpendicular to HJ.

The direction OG is defined by the angle 4, and angle 4 = 90° — angle 1.

The direction HJ is defined by the angle 5, and angle 5 = angle 2.

The parallel tangents and radii for any other required curves based on AB (fig. 3) may now be plotted, the intervals between circle centres being laid in the line OG (or OG produced), and the differences of radius being laid off towards or away from circle centres in a direction parallel with the radius at O.

In a similar way the tangents and radii for angles observed on another pair of objects may be deduced, the systems corresponding to each pair of objects being separated by the intercepts O O_1, etc., of figure 2.

The required curves may be plotted in relation to tangent and radius in any preferred way. If railway curves of specified radius are being used the variations will be as follows:—

$$\triangle \sin O = \frac{AB}{2 \triangle R}$$

$$\text{and } \triangle V = 1/2\ AB \triangle \cot. O.$$

(1) United States Coast and Geodetic Survey, "Special Publication" No. 143.

(2) Bostwick & Rosenzweig, "Dock and Harbour Authority," London, 1939, April.

(3) MacMillan, "Dock and Harbour Authority," London, 1939, June.

(4) MacMillan, "Hydrographic Review," Vol. XVI, No. 2, Monaco, 1939. November.

Hydrographic Surveys—continued

where O is the observed angle, between objects A and B,:—
$\triangle$ R is any finite variation of radius,
$\triangle$ V is a corresponding distance between circle centres,
and $\triangle$ sin O is the difference between the sines of successive angles.

Where integral variations of observed angle are being used:—

$$\triangle R = 1/2\ AB \triangle \text{cosec. } O,$$

where $\triangle$ cosec. O, is the difference between the cosecants of successive angles.

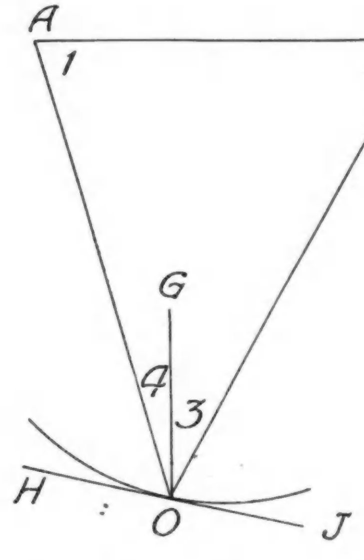


Fig. 3.

Each curve may, if preferred, be laid down by short chords, the direction of each chord being changed according to the angle subtended at circle centre. In large scale work such a figure may approximate very closely to the actual curve.

Where co-ordinates are required, the co-ordinates of each curve to axes tangent and radius may be computed, using sines and versines, and any required mathematical or graphical transformations can be performed. It will, of course, be appreciated that these operations, like most of those mentioned above, are of a quite minor nature, involving comparatively short distances.

Navigable Waterways of Africa

Urgent Need for a Co-ordinated International System

By BRIG. G. S. BRUNSKILL, C.B.E., M.C.

In these modern days of fast air, rail and road communications, the part which waterways could, and should, play in Pan-African development of trans-continental highways is apt to be overlooked.

At long last a Colonial Office spokesman has indicated in the House of Commons that endeavour may be made to convene a transport conference of the Western European powers territorially interested in Africa, i.e., The British Commonwealth, France, Belgium, Portugal and, to a lesser degree, Spain. These powers own between them the whole of the African Hinterland of Europe from South, East and West up to the borders of Abyssinia, Egypt and Libya (buffered by the Anglo-Egyptian Sudan). It has also been announced that Egypt and Abyssinia are ready to discuss British suggestions for better utilisation of the waters of the White and Blue Nile. In addition, President Truman, in his inaugural speech, pledged American financial help for development of areas such as the backward parts of Africa; the U.S.A. have already made good progress in Liberia. All such planning will obviously aim at improving living conditions for Africans, by opening up new routes and local industries, and at producing from Africa more raw materials and food to meet world shortages.

Full African planning demands supplementing West to East air routes by means of rail and road highways from Fort Lamy and Bangassou eastward, either through the desert to Sudan railhead El Obeid, or through the upper Belgian Congo to Juba on the Nile and to East Africa. Southern Rhodesian industry seems to require a new outlet to the West Coast by means of a railway to be constructed from Southern Rhodesia to Walvis Bay in South West Africa. Other requirements are a good highway linking South Africa with East Africa in improvement of the mere track (styled "The Great North Road") from railhead Broken Hill to Nairobi and an extension of the Kenya Uganda routes from the present terminus at Juba northward through the southern Sudan.

However, all existing transportation systems are already congested and new rail and road routes such as those referred to will take time to construct. It therefore seems essential to plan the fullest extension of capacity of navigable waterways, most of which are already main arteries with rail, or road, links by-passing those portions of the rivers where navigation is blocked by cataracts or low water. It must be remembered also that transport by inland water is infinitely cheaper than by road or rail, and that the comparative slowness of water transport is not of such great importance when a steady flow of certain bulk stores is required, including a large volume of cargo such as cased vehicles and machinery. Broadly speaking, Africa's principal inland water systems fall into the following groups in order of increasing importance—the rivers of the West African colonies, the chain of Central African lakes, and above all the trans-African route via the Congo basin and the Nile valley. This review will only touch on the first two groups and will be devoted largely to the Congo-Cairo system; only under that head will reference be made to particular methods of increasing speed and capacity of African inland water transport.

In West Africa hitherto it has been a practice of each colony, of each nation, to develop its own transport arteries direct inland from its most promising ports, utilising its own portions of navigable waterways as main parts of these systems. Happily, there have recently been Franco-British conferences to break down this rigidity and to plan the linking of the various systems for their most economic use by the group of colonies as a whole. The

Navigable Waterways of Africa—continued

French trans-Saharan routes, now under construction, could then be used to extract raw materials via West African ports. In this new conception, the navigable waters of the Rivers Niger and Benue, in particular, are of the greatest importance and can save much rail construction.

The Central African lakes do not, of themselves, offer prospect of either an almost continuous trans-African waterway or even of an airway for seaplanes. The terrain between the lakes is largely mountainous and much of it is unsuitable for the construction of rail links; most of the lakes are really inland seas, subject to violent storms, with consequent rough water which severely limits seaplanes' landings and moorings. These lakes, with their shipping, are, however, of great value as links in rail and road systems existing and projected. Lake Nyasa can provide a short cut for a new artery linking the Rhodesian portion of the existing main railway from the Union with the new "peanut" railway and port at Mikindani, via the Songea coal deposits. Lake and river transport already provides very important sections in an existing artery from Southern Africa to Kenya and Uganda. This artery runs by main railway from the Union to Bukama, or Kamina, in Belgian Katanga; by water transport on the River Lualaba, or by road, to Kabalo; by rail on to Albertville; by ship across Lake Tanganyika to Kigoma; by rail to Mwanza; by ship again across Lake Victoria to join the Kenya-Uganda railway at Kisumu. Lakes Tanganyika, Victoria, Kivu, Edward and Albert provide many other useful local links. Lake Albert, in addition, forms part of a system, subsidiary to and cheaper than the road, from the Uganda railhead to the head of the navigable White Nile at Juba.

Of infinitely greater importance than any of the above-mentioned waterways, however, are the navigable portions of the Rivers Congo and White Nile, which together constitute half of the only existing trans-African all-weather route; this runs as follows:—

DISTANCES IN MILES.

1.—MATADI-CAIRO.		Rail.	River.	Road.	Cumulative Total.
Matadi-Leopoldville	... ...	228			228
Leopoldville-Yambinga	(872 miles)				
Yambinga-Aketi	(140 miles)		1,012		1,240
Aketi-Paulis	(365 miles)				
Paulis-Gao	(45 miles)	410			1,650
Gao-Juba	... ...			360	2,010
Juba-Jebelein	... ...		846		2,856
Jebelein-Wadi Halfa	... ...	860			3,716
Wadi Halfa-Shellal	... ...		223		3,939
Shellal-Cairo	... ...	550			4,489
	Totals ...	2,048	2,081	360	4,489

2.—MATADI-NAIROBI.		Rail.	River.	Road.	Cumulative Total.
Matadi-Juba (as above)	... ...	638	1,012	360	2,010
Juba Soroti	... ...			335	2,345
Soroti-Nairobi	... ...	462			2,807
	Totals ...	1,100	1,012	695	2,807

In addition, the Congo River and its tributary, the Ubangi, form a substantial part of the main French Equatorial transport artery from their Atlantic seaport of Pointe Noire to Fort Lamy.

Much can be done to increase the speed and capacity of transport on the Congo and on the Nile. Practical plans for this improvement were made in 1942, but they were not put fully into effect because, before the necessary new equipment could be delivered, the North African campaign had re-opened the Mediterranean. This expansion plan naturally included additional wharfage, cranes, etc., at all the river ports concerned, but it also envisaged more important measures. Taking the Congo first, all tow boats were to be converted from wood-burning engines to diesel, to save labour and to give additional speed against the 5 knot current. The war prevented the import from Belgium of more of the usual prefabricated barges up to over 1,000 ton capacity, for assembly on the river bank at Leopoldville, but a plan was made for a supply of smaller ones in pieces from the Union of South Africa. These were to come by rail from Johannesburg to Port Francqui, and thence down the Kasai River by barge to Leopoldville for assembly. River lighting and tow boat searchlights were to be installed to enable continuous movement instead of tying up for the night. A new main Congo River port was to be constructed at Yambinga to overcome the low water problem on the River Itimbiri, up to Aketi, in the dry season; the railway was to be extended from Aketi to this new port.

The overland section of this route, between Congo riverhead Aketi/Yambinga and White Nile riverhead Juba, and thence to East Africa, could, and should, be greatly expanded, especially if it had to carry the traffic from Duala and Fort Lamy as described above. The railway could be expanded in gauge and extended to Juba; from Juba a link could be connected with Uganda railhead Soroti. Aketi, incidentally, is the point where the possible routes from the West via Bangassou could join this system.

On the White Nile between Juba and Sudan railhead Jebelein (below Kosti) somewhat similar measures to speed up and increase river transport were to be adopted in 1942. The chief difficulty here was the "Sud" with its constantly shifting tortuous channel and its floating "islands". A scheme for dredging a straight permanent channel had been shelved for years, even after the dredgers for it had been supplied, for fear of the dangerous results which might be caused by thus making the fall steeper and the flow more rapid. However, the great scheme for controlling the waters of the White Nile in Uganda, already referred to above, may at last result in the canalisation of this "Sud" area.

All these trans-African transport possibilities, and particularly those of the waterways, demand careful study and planning, firstly on a British-African basis and then on a Pan-African international scale.

The matter is urgent because there is some danger of certain schemes, such as that for Tanganyikan ground nuts, being allowed a priority of equipment, labour and money for new transportation systems which may prove to be detrimental to more important projects and to overall African needs. This full, long term planning is unlikely to materialise until a system of Pan-African conferences in Africa is instituted and until all African matters are concentrated in Whitehall into one African Relations Office.

New Dredger for the Mersey

Built for the Mersey Docks and Harbour Board, Messrs. Ferguson Brothers (Port Glasgow), Limited, launched early last month the large and powerful Twin Screw Bucket Ladder Barge Loading Dredger, "Mersey Engineer." She is the fourth vessel the firm has launched for the same owners within two years, and has been designed and constructed to the requirements of Mr. L. Leighton, the Board's Engineer-in-Chief.

The new dredger is of heavy construction throughout. Steam for dredging and propelling and for the main auxiliary services is supplied from two marine return tube boilers burning oil fuel on the Wallsend-Howden system. The main engines are triple expansion and operate the propellers through Ferguson Brothers' special type of clutches, or alternatively the dredging bucket chain through disengaging wheels at forward end of engines. The main engine room contains all the usual engine room auxiliaries and electric light generating plant. The massive gearing of the main dredging machinery has cast steel wheels with machine cut teeth. "Mersey Engineer" is designed to dredge down to 50-ft. below the water-line and has 41 buckets in the chain. Control of dredging is from a control house on main deck.

Accommodation for officers and crew is comfortably fitted out to meet all latest Ministry of Transport requirements.

For the stowage of spare parts and heavy anchors, there is an ample hold. Heavy steel beltings are fitted all round the hull. So that dredging may be carried out at night, a searchlight is provided on the forward framing.

The Pier Fire Problem

Prevention Methods Advocated for the Port of New York*

It is vitally important to the people of the Port of New York that the waterfront facilities be efficient, modern and safe from destruction by fire. It is estimated that one out of every ten persons gainfully employed in the metropolitan area is directly or indirectly dependent upon the port for a livelihood. This is particularly so with respect to the City of New York. According to the City's Department of Marine and Aviation, thirty-nine of the city-owned piers are more than fifty years old and some of these thirty-nine are seventy years old. Eighty-nine of the piers are over forty years old. A survey made by that department has indicated that seventy-one are in poor condition, while sixty-three are in only fair condition. Privately-owned piers it seems are likewise generally aged.

Fire Prevention Disregarded

When the piers were built the possibility that they might be vulnerable to destruction by fire seems not to have been either thoroughly explored or appreciated. The result has been that their design and construction did not incorporate features that would restrict the horizontal spread of fire in either the substructure or superstructure. It is this unhampered horizontal spread of fire that has caused what would ordinarily be a relatively small fire to become a conflagration type fire that destroys the entire pier. The word conflagration being defined as "a great or extensive fire." Not every fire that originates on a pier reaches conflagration proportions, for many of them are extinguished by the fire-fighting forces while still relatively small. If only very infrequently a pier fire became of conflagration proportions or if such fires were due to an exceptional combination of circumstances, perhaps there would not be too much concern. The records over a period of years, however, show that this is not true. They show that once a pier fire extends beyond a certain point it cannot be extinguished until the pier is a complete wreck. They show, going back no further than the Cunard Pier No. 54 fire of 1932, that eleven additional piers have succumbed to the conflagration type of fire. Considering the number of piers in New York harbour it may be argued that this is not a terrific loss even though in a monetary way it has run into multiple millions, but each and every one of these losses is far beyond what was reasonable. In addition thirty-nine lives have been lost and many persons have been injured. Every time a pier is destroyed there are intangible losses such as the disruption of shipping and of an economic nature that may be very considerable. There is also the loss of commodities that can never be replaced which, today and for some time to come will mean a reduction of many necessary articles needed in this and foreign countries. If the pier is not replaced, then these losses may become more or less permanent to the detriment of the port.

It is distinctly regrettable that although these serious pier fires have been thoroughly studied and much time and energy expended in determining methods of preventing them, very little has been accomplished in the application of the knowledge acquired. Since the piers that burned were fundamentally not different from those remaining it is reasonable to assume that any of the existing piers may be consumed by fire at any time. This certainly is not a condition to promote peace of mind in either the insurance companies, the city authorities, the shipping industry or the people that must work upon the piers.

Two Types of Fire

Piers are very deceptive from the possibility of destruction by fire viewpoint. To some experienced in fire prevention, and especially to the layman, many of the piers appear to be constructed of material that will not burn, and therefore are incapable of sustaining severe fire damage. The sides are frequently corrugated iron on steel framework, which also supports steel trusses that carry a heavy plank roof. The deck is either heavy wood planking or asphalt or concrete or a combination of these materials on very heavy wooden cross members on wooden piles. The very fact that all wooden members are of such substantial dimensions tends to the belief that they will not either ignite readily or once ignited cause the fire to spread rapidly. Experience, however, has shown repeatedly that this is not true. Experience has also shown that piers are subject to two distinct types of fire, either of which is disastrous. One is the type of fire that originates below the deck in the wooden cross members and piling, burns away the cross members and the tops of the piles and drops the pier into the river. This type of fire, known as a substructure fire, may or may not extend to the pier shed above the deck, and the merchandise it houses, but generally results in complete loss of the entire pier and its contents. The other type of fire is the kind that originates above the deck, usually in the merchandise upon the pier, and quickly spreads throughout the pier shed. It is known as a superstructure fire and usually results in the collapse of the side walls and roof of the shed with complete loss or severe damage to the shed and its contents. This type of fire may or may not extend below the deck, but does not always destroy the substructure.

Central portion of pier has collapsed into river. Substructure is burning under entire pier. Fire department efforts are being concentrated on preventing spread to adjoining piers via the substructure of the bulkhead building at the shore end.

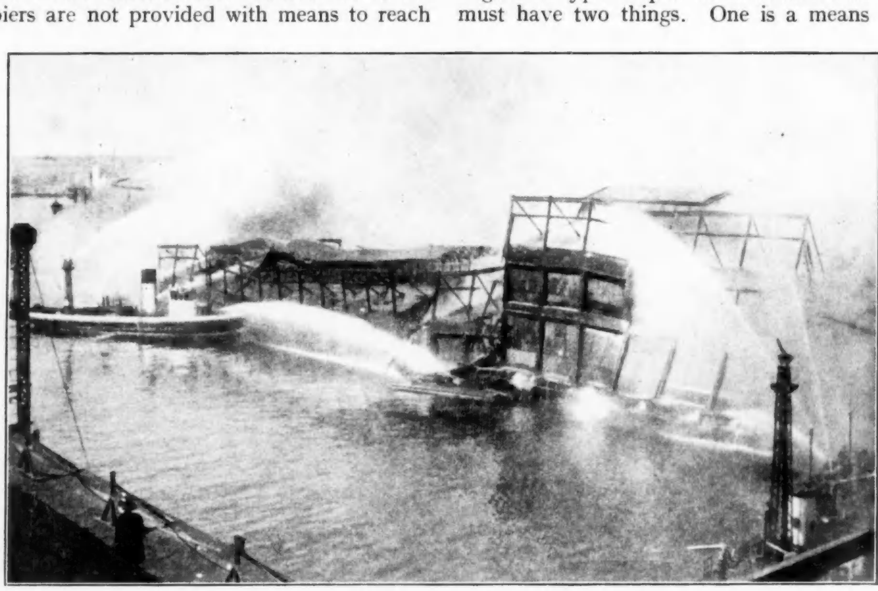
Recently there have been two fires in New York Harbour. One of them was a superstructure fire that almost completely burned away the pier shed and is the type of fire that is more readily anticipated. The other was a substructure fire that is more difficult to understand. In both cases the result was disastrous. It may be seen, therefore, that if a pier is to be rendered free of the possibility of destruction by fire the substructure and the superstructure must each receive individual attention.

If we examine into the reasons for the conflagration characteristics of the substructure fire we find that it is due to the existence of

*Report issued by the New York Board of Fire Underwriters and reproduced by permission.

The Pier Fire Problem—*continued*

a large quantity of wooden members, many of which are in a thoroughly dried-out and sometimes splintered condition, that these wooden members cover a large area not possessing any barrier to the horizontal spread of the fire, and that a large proportion of them are in locations not readily accessible to the fire-fighting forces. A pier is essentially a warehouse housing quantities of all types of merchandise, but who, having any concern fire prevention wise, would build a warehouse on a foundation consisting of wooden poles or any other combustible material without making certain that fire could not destroy the foundation, and thereby destroy the warehouse and its contents. This though is exactly how the piers are constructed, and in addition, they, of course, are over water, making it just that much more difficult to reach and extinguish any fire in the substructure. Almost all of the piers are not provided with means to reach and extinguish fire in the substructure. Fireboats throw water under the deck of the pier from the sides, but this water usually does not penetrate much farther than twenty feet before it is broken up by the substructure cross members and becomes ineffective. In a one hundred foot wide pier this means that the central portion of the substructure, approximately sixty feet in width, remains dry, and the fire is free to spread throughout the length of the pier, burn away supports and drop the pier into the water. Land companies of the fire-fighting forces are presented with what may be termed an upside-down fire in a location they cannot reach without cutting holes through the deck through which they can insert various types of nozzles to get water on the fire. This process of cutting a hole through the deck is not an easy matter especially if the deck consists of two inches of asphalt on six inches of reinforced concrete on four-inch wood planks as it did in the Grace Line Pier 57 fire. Under emergency conditions this is a superhuman task and takes considerable time. Before the deck can be perforated sufficiently to properly attack the fire, the fire spreads past the location where the openings are being made because there is no physical barrier to stop it, with the result that the fire-fighting forces must retreat to a new location farther along the pier. By this time the horizontal travel of the fire becomes so rapid that cutting holes through the deck to extinguish it, or form a water curtain to stop it, is out of question and the pier is abandoned in so far as fighting the fire from the pier itself is concerned. It is then just a matter of time before the pier settles into the water.



Practically the entire pier has settled into the river. The ineffectiveness of streams of water from fire boats for extinguishing the fire in either the substructure or the superstructure is apparent.

Substructure Fire Prevention

We find then that to prevent the conflagration type of pier substructure fire we must have two things. One is a means of preventing the horizontal spread of the fire and confining it to within certain predetermined limits. If the fire-fighting forces know that the fire cannot spread beyond certain limits they can then concentrate on extinguishing it instead of using all efforts to cut it off from the balance of the structure. The second is a means of reaching the seat of the fire, making it accessible to the application of water so that it may be extinguished readily.

If these two things are done any substructure fire will cause damage to a pier only to an amount determined by the limits set beforehand. If we examine into the first requirement, that of restricting the horizontal spread of the fire, we learn that this may be done in two different ways. We may erect a permanent barrier in the substructure in the form of a wall or we may provide means for establishing a water curtain in various ways. If we instal permanent walls we are reasonably certain that under all conditions the walls will be there to perform as intended. They require no particular action or training on the part of the fire-fighting forces and little, if any, maintenance. If we elect to use the water curtain we may experience difficulties with the water supply or we may find that the equipment provided to create the water curtain, if of a portable nature, may be improperly handled or placed. This may also be true of non-portable equipment.

Walls, if erected, should not be over one hundred and fifty feet apart, but of course, the closer they are the better. Walls may be constructed in various ways. If they were built of combustible material such as heavy planking or will not resist the passage of heat from one side to the other they should be protected by a water curtain arrangement of open nozzles on each side, directed against the wall and supplied with water through a Siamese connection on each side of the pier. Such a water curtain system, of course, requires a certain amount of maintenance. A wall that would resist the action of salt water, ice and perhaps debris in the river, and would not require the water curtain system, could be constructed of one-half inch wrought iron plates about a foot apart filled in between with an insulating material. To save metal the double or insulated part of the wall may need to extend only one-half the distance between the underside of the deck and mean low water or at least three feet, with a single plate extending the balance of the way. Such a wall could be constructed in sections and floated under the pier, riveted or welded together and bolted in place tight against the underside of the deck. It would probably give a trouble-free service for many years without any particular maintenance and would also not require many, if any, additional supporting members.

The second requirement, that of providing means of readily placing water upon the fire, may be accomplished in several ways. We may place automatic sprinklers under the deck. We may place open sprinklers or just open nozzles under the deck, controlled either automatically or manually. We may instal rails for the use of Mono-Rail Nozzles or we may make holes in the deck so that nozzles of various types may be inserted to direct water on the burning members. Several other methods for getting water up on the under-side of the deck have been attempted or suggested from floating nozzles controlled by ropes to explosives discharged in the water to splash it upward, but they are impractical.

Automatic sprinklers, a keystone of protection nearly everywhere, are not entirely suitable at present for substructure protection in the New York Port area. This is because the standard sprinkler head is designed to throw most of its water downward and not upward as is required under a pier deck. The water supply to the sprinklers is also a problem because of the possibility of freezing and because of the more or less considerable movement of the pier due to its flexibility.

The Pier Fire Problem—continued

The corrosion effect of salt water, floating ice and debris, the possibility of pilferage and the concealed nature of the installation may make the maintenance an over-sized item to contend with. Most of these objectives would also apply to open sprinklers of nozzle systems. It is conceivable that a re-designing of this type of equipment may produce a suitable system.

The "Mono-Rail Nozzle" system consists of structural I-beams installed on the under-side of the deck so as to run across the entire width of the pier. The beams are spaced at suitable intervals of not over twenty-five feet, and generally in alternate bays. At the time of a fire a hangar or carriage with one or more special hose-nozzles is placed on the lower flange of the I-beams, and is propelled along the rail to whatever distance may be desired by the jet reaction of the water discharging from the nozzle, which water is also thrown against the underside of the deck and the other members of the substructure. This system was tested and listed by the Underwriters Laboratories in 1933. Only one complete installation on a comparatively small pier appears to have been made since that time. It has never been used in an actual fire to the present. There seems to be little doubt that the Mono-Rail Nozzle system, if properly used, would extinguish a substructure fire at least in its early stages. Like the sprinkler devices, it requires a certain amount of maintenance because of the salt water corrosion factor, also the fire-fighting forces must be instructed in its use.

Openings in the pier deck, properly arranged, appear to be a reliable, simple, economical way of providing a path for the easy and efficient estinguishment of a substructure fire. These openings would be located between every row of piles and not over twenty-five feet on centres across the pier. They must be provided with covers and insulated so that they will resist the passage of heat and fire equivalent to that of the deck, so that merchandise may be placed upon them as desired for the efficient operation of the piers. It is felt that if walls are provided in the substructure time may be taken by the fire-fighting forces to move merchandise when and where necessary to make the opening in the deck accessible. The openings should not be over ten inches in their greatest dimension, but may be smaller. The size of such openings could be reduced to about three inches in diameter if a little effort were expended in the construction of nozzles especially designed to fit the openings and to throw water up under the deck where it is needed. Openings of the three-inch diameter size could probably be easily drilled through the deck of any pier in the port. The openings could then be fitted with a length of three-inch pipe with a three-inch coupling at the top end and a pipe flange at the lower end. The coupling would be placed flush with the top surface of the deck and be closed with a three-inch brass hollow head plug. The pipe flange would be flush with the underside of the deck so that the whole assembly could be fastened to the deck. A non-corrodible spider could then be inserted into the pipe opening to support a plug of insulating material. Nozzles for use with the three-inch openings could be constructed cheaply of two and one-half inch pipe, a tee, nipples, control valves and couplings for two and one-half inch hose. By the use of three-inch openings in the pier deck and the development of special nozzles for such openings, substructure protection could be provided for all of the New York piers on a production basis and in the shortest possible time. The working end of the nozzle could simply be the end of the pipe capped and drilled to throw the water at the proper angle, or a more elaborate tip could be designed to properly distribute the fire's spread. In operation it would only be necessary to screw out the brass plug of the dock opening and insert the nozzles as far as they would go, which at the same time would knock out the insulating plug. Once the fire was confined time would be available to move cargo to reach other openings for the insertion of other nozzles to extinguish it. Openings in the pier deck under no circumstances should be constructed so that they will permit spilled inflammable liquids to penetrate to the substructure and cause a superstructure fire to extend to the substructure. Openings in the deck should not be so large that when opened they will permit a large amount of smoke and hot gases from a substructure fire to enter the superstructure, making it untenable to the

Except for small portion at shore end, superstructure of pier was practically consumed. The photograph indicates the proportion of pier that is subject to operations of the land companies of the fire department when fire sweeps through entire pier. The photograph also indicates that the amount of merchandise on the pier was not great, and was not a major contributing factor to the extent of the fire.

water. Nozzles at present in use for fighting cellar fires do not appear efficient for a substructure fire where most of the water must be thrown at an upward angle. The proper length of the nozzle or pipe could be predetermined for the particular pier on which it was to be used so that it could be extended its full length through the opening and be at its most efficient location under the deck. A sufficient number of nozzles could be kept in a readily accessible location on the pier for the use of the fire-fighting forces, and several nozzles may be connected together and to the stand pipe system so that they could quickly be placed through several deck openings to form a water curtain and restrict a fire-fighting forces and possibly causing a substructure fire to extend to the superstructure. Large openings may also be an aid to pilferage.

Maintenance of equipment is always an item of considerable importance where fire prevention is concerned because of the possibility of failure at the critical moment even if cost were not a factor. It is essential, therefore, that maintenance be thoroughly considered when a choice of any substructure protection is considered.

In any event if walls are installed in the substructure and means are provided for reaching and extinguishing the fire it seems certain that although some damage may be

The Pier Fire Problem—*continued*

caused by substructure fires there will be no more of the conflagration type that destroys the entire pier and its contents.

Superstructure Fire Prevention

To prevent the conflagration type of fire in the superstructure of a pier, the horizontal spread of fire must be prevented to no lesser degree than in the substructure. In pier superstructures this horizontal spread of fire has been found time and time again to be very rapid, in fact so rapid that the fire-fighting forces have lost equipment driven down the pier to attack a fire near the river end of the structure because it could not be driven back off the pier quickly enough. Watchmen and others have been killed or injured simply because they could not race the fire to the end of the pier. Pier sheds have been likened to long flues and act in just about the same manner. Fire at one spot on the pier sends hot gases and sparks up until they hit the underside of the roof, and then rebound and start fires at another spot quite a few feet farther along the pier. The fire-fighting forces cannot extinguish such a fire before excessive loss is sustained. They may, in fact, quite likely be defeated before they have left their quarters because of the rapid-spreading characteristics of some pier fires.

Superstructure fires differ from substructure fires in that they are essentially fires in the merchandise upon the pier, whereas the substructure fires are the burning of the pier substructure itself. Experience has shown that a pier does not need to be loaded with merchandise before it may be host to a severe fire, nor does the merchandise have to be of an exceptionally flammable character. Some piers have been destroyed when they contained less than one-third of their capacity.

Preventing the spread of fire in the superstructure of a pier may be done by the erection of walls transversely across the pier at three hundred foot intervals. Such walls must necessarily be provided with large openings for the movement of traffic down the pier and the openings need to be protected by fire doors, if the wall is to be effective. Since the fire doors must be excessive in size they become cumbersome and require constant maintenance. In addition, it is claimed the walls hinder efficient operation of the pier. It appears that the walls may not be entirely necessary in the superstructure if adequate sprinkler protection is provided, coupled with numerous draft stops and automatic skylights. This, of course, applies to a one-storey pier that does not handle hazardous material such as flammable liquids that may not be controlled by sprinklers. On piers handling merchandise with inflammable qualities greater than normal, walls are a definite necessity to reduce excessive area.

In any event automatic sprinklers throughout the superstructure are an absolute necessity. Such a system must be a dry system where there is a possibility of freezing. Recent developments in pier sprinkler protection have tended to decrease the normal cost and increase the efficiency of such equipment considerably by locating the dry valves at the land end plus the use of exhausters and automatic detecting and operating devices.

Draft stops are simply a means of confining hot gases from a fire to a certain area near the roof to accelerate the action of sprinkler heads, and prevent for a time the travel of the gases along the underside of the roof. They may consist of corrugated metal, transite or other incombustible rigid material fastened to and covering at least one side of a roof truss at no greater than one hundred foot intervals, and extending from the roof to the bottom chord of the truss.

Skylights are important in the superstructure in preventing the horizontal spread of fire by permitting the fire to vent itself vertically. Skylights should be arranged to open automatically or break when the temperature exceeds 165° F. They should be located in the very peak of the roof midway between the draft stops and be as large as practicable, but at least five by twenty feet.

It should be realised that a pier is accessible to the land companies of the fire-fighting forces from only the narrow shore end, and that when they are driven off the pier fire-fighting is then almost entirely a matter for the marine forces. Many pier fires originate in cold weather or during a week-end when the pier is not in use. This means that cargo doors are closed and access to the pier is not easy. Pier walls and roof are designed to shed water and consequently it may be very difficult for the marine fire-fighting forces to get any water into the interior of the superstructure effectively. In addition, fireboats may be hampered by barges or large ships that may become ignited and require their full attention. Removing a large liner from the side of a pier afire is not an easy task.

Many of the piers employ the use of comparatively light steel trusses to support the roof. It does not require much heat to bring the temperature of the lower chord of the truss to the point where it loses its stability with the result that the truss and roof collapse. The collapse of the roof draws the side walls inward, making the structure look something like a double tent and quite effectively locking out the fire-fighting forces. It would seem, therefore, that fire-resistive cubbyholes installed in the side walls of piers from which a fireman could operate a hose-line to the interior of a pier in comparative safety are necessary. Such cubby-holes could be spaced midway between fire walls. Instead of cubbyholes thin glass window openings in the pier sides may permit streams from a fireboat to reach the interior of a pier.

Fire lines, alarm boxes and watchmen are all part of proper pier protection as are means of safeguarding special and common hazards, such as electrical equipment and heating equipment, tractors, lamp rooms, etc. These hazards are not peculiar to piers, and the methods for safeguarding them are well known and established, consequently, they are not given detailed attention in this paper.

Improvements a Necessity

Everyone concerned about piers in the Port of New York agrees that something must be done about the City's pier system. The City, aware of the importance of the port to the community's welfare, has developed a plan for improvement, but funds apparently are not available. For months independent teams of engineers have been going over the waterfront. A whole series of plans have been formulated, but what is needed now is municipal action.

These plans deal only with the city-owned piers. They do not include the privately-owned ones that presumably will not be given any particular attention. It seems, therefore, that specific requirements governing the construction and protection of piers and wharves is a necessity for the city and should be enacted.

Fire-fighting must begin at the architect's drawing board, not at the alarm box. Fires, of course, will originate on piers, but the erection of an expensive pier, so lacking in the essentials of fire prevention that the careless toss of a cigarette can burn it to complete destruction, cannot be justified.

REVIEW

Mémoires et Travaux de la Société Hydrotechnique de France—Vol. 1, 1949. Published by "La Houille Blanche," Paris.

There are two papers of interest to river and harbour engineers in this volume of proceedings.

The first is a note on the transportation of sediment in water streams by M. André Nizery, being a summary of the discussions which took place at the second meeting of the International Association for Reasearch into Hydraulic Structures, held at Stockholm in June 1948. These were as follows:

No. 1. The distortion of scales in model with loose beds, by H. Chatley.

No. 8. The Stability of Prisms at the bottom of a flume, by P. Novak.

No. 10. Transport of bed material and erosion at the foot of barrages, by L. T. Tison.

No. 15. Formulas for Bed-Load transport, by E. Meyer-Peter and R. Muller.

No. 19. Equations used in India for flow of water and sand in alluvial channels, by C. Inglis.

No. 20. Reappraisal of beginnings of bed movement, by F. T. Mavis and L. M. Laushey.

No. 30. The dragging of materials, by P. Daniel.

M. Nizery deals with Nos. 10, 15 and 20 at considerable length.

The second paper is a communication presented to the Society in June 1948 on wave filters, by M. Biesel. This gives a very succinct account of the reflection, shielding, shore dissipation, energy change and breaking of waves.

There is also an interesting article on the cutting off of bends in the river Isère above Grenoble and the use of models in connection with this study. H.C.

Correspondence

To the Editor of *The Dock and Harbour Authority*.

Dear Sir,

Tidal Models

My father used to tell me that in his young days—allegedly more narrow-minded than our own — public controversy on matters religious, political and scientific was more outspoken than in our times, and that correspondingly it was more stimulating and helpful to all concerned. In that spirit, I welcome Dr. Doodson's forthright letter in your May issue.

The impression created by his letter and by his Paper which you reproduced in January, however, may well be that those who have been actively associated with tidal model investigations have given little thought to the physics and mathematics underlying the experiments. In particular, the term (d) of his equation has, he affirms, been completely ignored; i.e., no one has appreciated the phenomenon of energy-loss; much less has anyone attempted to explain its implications. I hope that the quotations and references I shall now make will prove this view to be mistaken.

Dr. Doodson implies that I have claimed that the textural friction-coefficient in the Severn model was 40 times as great as in nature. Of course, I did nothing of the kind. I contended that (i) the resistance is only *partly* affected by textural roughness and that (ii) even if it were wholly due to textural roughness, the corresponding coefficient of friction is not independent of the dimensions of the channel. These two reasons *together* indicated a fundamental fallacy in the dimensional analysis which leads to the general conclusion that the horizontal scale must be the same as the vertical scale.

Consider for a start the case of uniform flow along a *straight* rectangular channel. The equation is $h=\frac{flv^2}{2gm}$. Let capital letters refer to a large channel and small letters to its model. If the vertical scale is 1 : y and if, (as in *tidal* models), $\frac{v^2}{V^2}=\frac{1}{y}$, then $\frac{h}{H}$ should $=\frac{1}{y}$ when $v=\frac{V}{\sqrt{y}}$. We assume that the resistance is sensibly proportional to the square of the velocity.

Now take the example of a model channel 3 inches wide covered with *stationary* grains of a size (0.007 inch) equal to those used in Professor Gibson's Severn models. Calculations based upon evidence contained in Phil. Mag., June 1934, p. 1081—and Journ. Inst. C.E., April 1943, p. 91—show that if this channel is 1 inch deep, $f=0.0065$. If it is 2 inches deep, $f=0.0059$. These textural friction-coefficients are themselves approximately *three* times as high as for channels also roughened with fixed grains of the same size (0.007 inch) and having depths of 200 or 400 inches and widths of 600 inches or more. With the same material, therefore, the friction loss of head in this model (scale 1 : 200) would be 3 times too great at corresponding velocities. To compensate for this, it would have to be made smoother in texture or alternatively a vertical distortion of scale would have to be adopted so as to make $\frac{M}{m}=\frac{F}{f}x$, where 1 : x represents the horizontal scale. If f were erroneously assumed equal to F, (instead of being appreciably greater than F as we see it is), then $\frac{M}{m}=x$, which means that no vertical distortion should be used : a wrong conclusion.

Further calculations based upon Journ. Inst. C.E., April 1943, p. 91—and Paper 17 of the U.S. Waterways Expt. Station, January 1935, reveal that if the sand grains in the 3 inch wide model channel were in general movement, giving rise to ridges in the bed, the values of f could increase to approximately 0.060 and 0.050 respectively according to whether the depth of stream was 1 inch or 2 inches, and that these values of f would be 5 or 6 times greater than those appropriate to an *exceptionally rough* earth channel of 200 times the width and depth as compared with the model.

The dependence of f upon the dimensions is evidently, therefore, not a negligible factor. It still leaves a great deal to be explained, however, when vertical distortions of the order of 40 : 1 are employed, and I have myself written elsewhere that cases arise in which a trial-and-error adjustment of the model surfaces by the use of "stuccoed concrete, exposed sand or pebble aggregate, the ribbing of cement or concrete surface by chisels or other tools, and the introduction of wire-screens along the surfaces of the permanent banks" may be the only solution. What of the cases where no such artificial devices have been required? Fifteen years ago, Professor Gibson, in a Paper read to the Royal Institution, offered this explanation:

"Actually, in any model of a large river or estuary having a sandy bed, the resistance is almost entirely due to eddy formation caused by curves and irregularities in the sides, and by irregularities in the depth whose magnitude and effect is overwhelmingly greater than that of a change in the textural roughness of the surface itself.

"Recent experiments by the author on the resistance to flow around an easy bend in the model of a canal of uniform cross section showed no difference whether the surface was smoothly painted or was coated with coarse sand, practically the whole loss of head being due to eddy formation and interference between the cross currents set up."

More lately (Journ. Inst. C.E., Feb. 1939, p. 115), it has been shown that in certain non-tidal reach of the River Mersey, the bends account for three-quarters of the total resistance at dry weather flows of about 350 cusecs and for one-half at heavy flows of about 7,000 cusecs—despite the fact that this River is equivalent, in textural roughness, to a rectangular section of the same average hydraulic mean depth roughened with projections *6 inches* high. In an estuary of irregular form, with pronounced changes of section and shape, and projecting pieces of coastline, superimposed upon bends, it is not unreasonable, therefore, to suppose that textural roughness as such will contribute comparatively little to the overall resistance. Moreover, it appears that the other losses (caused by major eddy-formation) are approximately proportional to squares of velocities, or to squares of velocity-changes, and consequently that they are reproduced in a model in accordance with the vertical scale (as they should be) provided the scale of velocities is proportional to the square-root of that scale. How otherwise can one explain the strong similarity in tide phenomena as among themselves of three models of the Severn with different scales? (a) horizontal 1 : 8,500, vertical 1 : 100; (b) horizontal 1 : 8,500, vertical 1 : 200; (c) horizontal 1 : 40,000, vertical 1 : 366. (Severn Model Reports 1933 and Journ. Inst. C.E., March 1938, p. 210.)

Another matter of some interest as regards the tides *west* of the English Stones is that Sir Geoffrey Taylor has shown (Proc. Camb. Phil. Soc., 1921-22, Pt. III, p. 320), that the great increases in tidal *range* from Ilfracombe to Portishead may be calculated very closely by the geometrical analogy of an estuary with breadth and depth both proportional to the distance from the top (taken as at Portishead). His analysis (dealing only with *amplitudes* of tide) ignored friction, but it is not without significance that it gives close accuracy at many intermediate places as well as at the ends, and that the form of the equation is such that it would be satisfied by a model with a horizontal scale of 1 : x and a vertical scale of 1 : y so long as the time scale were chosen as $1:\frac{x}{\sqrt{y}}$ which is the normal procedure in tidal models. (See also Journ. Inst. C.E., Dec, 1940, p. 107.)

I come next to the question of the reproduction of the Severn bore. Dr. Doodson could hardly have been more scathing in his reference to this if the model had *failed* to generate a bore! He argues that "any wave, large enough in amplitude, and moving 'according to depth' at the critical parts of the river, however generated, would produce it." But surely the point is that a bore of remarkably true height and speed was produced by a tide of the *proper range* at Avonmouth, and that the effect of a variation in the conditions of the river (for example, the configuration of the channel between Sharpness and Hayward's Point) was quite noticeable, as in nature. Further, it seems to me that the characteristics of the bore depend not only upon the range of tide (for example there is no Severn bore with ordinary neap tides) but also upon the rate of rise of the tide and upon the mean tide level. A very careful study of the whole phenomenon appears in

Correspondence—continued

Professor Gibson's Severn Model Reports, 1933, Section IX. In another model—of the Cheshire Dee—it was found that, provided the bed was of a shape conforming with that in existence at the time of observations in the actual estuary, the speed of propagation of the bore between Connah's Quay and a point near Chester Weir agreed with the estimate of eye-witnesses within one per cent., and moreover that the model also behaved correctly in showing that the surface current followed the bore at a speed of about 0.75 of that of the wave-crest. (Journ. Inst. C.E., June 1939, p. 30- and Phil. Mag., May 1938, p. 754-.) Having regard to the small width of the model channel—about 1 inch— and the vertical exaggeration of scale (25 : 1 in this case), this does not seem to lack significance or interest. It might have been feared, for instance, that surface tension would vitiate the results.

Yours faithfully,
JACK ALLEN.

24th May, 1949.
Department of Engineering,
University of Aberdeen.

To the Editor of *The Dock and Harbour Authority.*

Dear Sir,—

The Future of Inland Waterways.

While not agreeing in every detail with his suggestions, this Association would like warmly to endorse " Windlass's " letter in your June issue: and also to thank you for your Editorial comment offering general support. There is little about the present condition and management of British inland navigation to warrant any optimism whatever.

This Association, which draws its Membership from all walks of life and all parts of the world, is disinterestedly concerned to promote the restoration to good order of all British navigable waterways and their full use for both commercial and pleasure traffic (not overlooking that pleasure traffic is also commercial, in that it pays tolls). We have been into the question very fully and have no doubt as to what is required.

1. Before any abandonments of waterways are sanctioned, and before any large scale projects for waterway reconstruction are formulated, we recommend that a careful detailed survey and report should be made upon the inland waterway resources of this country. Above all, especially in the present reduced economic state of the country, the most careful and impartial examination should be made into the real cost of canal transport of suitable (mainly, of course, bulk) loads; and this cost compared with the real cost of transporting similar loads by other means. We have no fear of the comparison; but we do ask for a completely independent enquiry. Our case is that the working of the canal industry has hitherto been so completely unco-ordinated and chaotic (being largely kept so by the deliberate policy of hostile transport interests) that it is cause for some wonder that it has survived at all and proof of the industry's great inherent strength; and that under unified management (particularly in respect of tolls) there could readily be brought about an increase of real value to the nation in the traffic carried. As an example of the tolls structure I quote the following rates recently charged for the same boat on a through journey:

Napton to Kingwood (Grand Union Canal)	22 miles	£2	12	6
Kingswood to King's Norton (Stratford Canal)	12 miles	£1	4	0
King's Norton to Worcester Bar, Birmingham, (Worcester and Birmingham Canal)	5 miles	£1	16	0
Aldersley Junction to Autherly Junction, (Staffordshire and Worcestershire Canal)	½ mile		7	6
Autherly to Nantwich (Shropshire Union Canal)	38 miles		12	0

Nine miles on the Staffordshire and Worcestershire Canal can cost £1 13s. 4d.; while forty-eight miles on the adjoining Trent and Mersey Canal cost 18/-.

2. We consider that there should be a national canal policy, such as is applied with conspicuous success in various other countries. We consider that all surviving navigable waterways should be maintained to a clearly defined standard of navigability able to be depended upon in all normal circumstances by the trader and boatman; should be freely open to all boats of suitable dimensions; and should be available at a standard scale of tolls, operated on a nation-wide basis and readily ascertainable in advance. There seems to be no good reason why the same rate per mile should not be applicable everywhere within the nationalized system, subject to local modifications to meet special circumstances. The canal industry has been ruined by a policy of regarding each waterway in isolation; a policy strongly and notoriously fostered by the former railway owners. The aim should be to make the system pay as a whole; which it certainly will not do if managed on a piecemeal basis. That aim has been successfully achieved in other countries. The turnpike road should no longer be our model. If the branches are cut off or neglected, the whole tree will die.

3. Above all, as " Windlass " so truly points out, the waterways should be publicized. We consider that the occlusion under which the industry has lain so long has largely been the cause and not the result of its present condition. Few traders ever come to hear the possibilities of canal transport. It is often a matter of the greatest difficulty to obtain information of any kind, even when the trader takes the initiative. The waterways industry is too much in the hands of officials at all levels who have no belief in its future, and little knowledge of its present condition and peculiar past history. The relevant trade associations, such as they are, are concerned only to secure for their members (mostly trading in a single small area) a quota, the steady diminution of which they make no attempt to resist. To advocate a policy of expansion in certain influential trade circles is notoriously to court expulsion.

4. Labour, as you state, is in full flight from the cut, particularly since nationalization. Our enquiries suggest the remedies to be simple: an increase in water-borne trade; and sympathetic consultation with the boat people upon the improvements in their conditions which *they* require. No good purpose is served by changes which remote employers or equally remote trade union officials think the boat people ought to retire. Many managers and many trade union officials regard the boat people and their way of life with ignorant contempt. A general and efficient policy of dredging would do much in itself to retain for the canals the families who have always worked upon them.

A series of public enquiries has recommended revolutionary and constructive changes in the canal industry. None of their recommendations has ever been carried out, mainly, it may be supposed, owing to railway opposition and public indifference. When we remarked recently to a prominent official at the Ministry of Transport that the special rate covenants referred to by Windlass are still enforced to the utter ruin of the canals (the purpose the covenants were designed for), the reply was that one cannot expect an old dog to learn new tricks. But most of the waterways are now public property; and it is your readers who should take the lead in educating or removing that dog.

Yours faithfully,
R. F. AICKMAN,
Chairman.

The Inland Waterways Association,
11, Gower Street, London, W.1.
20th June, 1949.

Port of Belfast Improvement Plans.

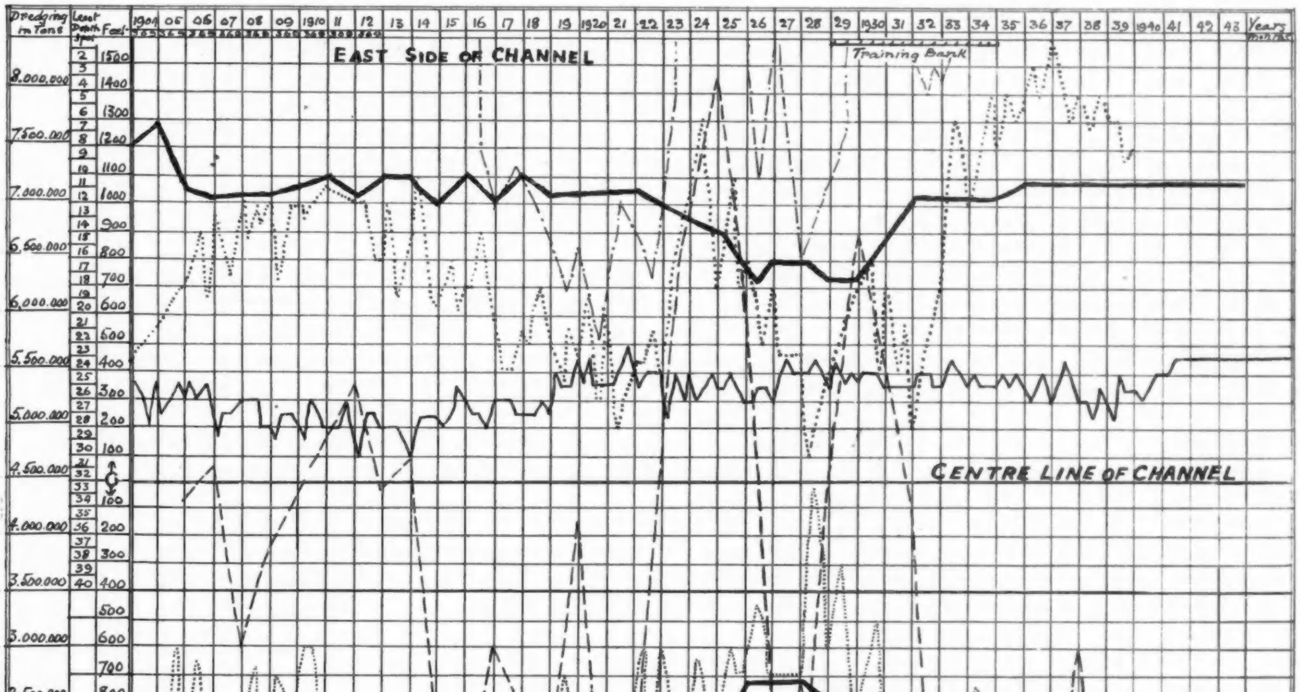
Two important improvement schemes have been approved by the Belfast Harbour Board. The Musgrave Shipyard steel and iron delivery wharf serving Harland & Wolff's Musgrave yard has been damaged by timber-boring organisms and it has therefore been decided to provide a new concrete structure for a length of 225-ft., so as to permit a depth of 21-ft. 3-in. below harbour datum to be dredged if necessary. The second scheme for which authority has just been given is for the refronting of the north wall of the Spencer Dock entrance. This will reduce the width of the entrance from 175-ft. to 160-ft. but will provide a depth of water of 21-ft. 3-in. for the entire width, instead of for 115-ft. as at present. The Board considered that alternative schemes would not provide additional quayage, and that the money involved could be better spent on building new accommodation in the Herdman Channel or elsewhere if the necessity should arise. Pilots and tugmasters are agreed that the narrowing by 15-ft. of the Spencer Dock entrance will be more than compensated for by the uniform depth of water over the entire width.

Hydrographic Graphs

Their Value As Port Conservancy Records

In all ports, whose waterways are subject to appreciable fluctuations in navigable depths and shoaling, thereby necessitating frequent hydrographical surveys to ensure safety in navigation to shipping, it is essential that results of all surveys should be available in some tabulated form, from which the fullest data for observation and future investigation can be easily and rapidly extracted. The principal purpose of a hydrographical survey of a waterway—and comprising within that term, approaches to the port area, sea channels, river, etc.—is, of course, to ascertain the minimum depths therein, as applicable to navigational requirements of vessels making use of the port. Each survey, however, serves an additional and valuable purpose from the point of view of a Port Authority, in providing constant comparison between the surveys as a means of determination of the general prevailing condition of the waterway, over periodic intervals, relative to stabilisation, improvement or deterioration in regime. Surveys are also necessary as complementary to any dredging in operation, which may be in progress, as a regular or extraordinary feature. It also acts as a check upon efficiency with regard to the accuracy of location of dredging and to the removal of silt to the required depth. Surveys, too, constitute the only reliable basis from which observation is made as to the exact reaction of the general condition of a waterway to certain influences, i.e., tidal action, dredging, construction works, etc. In many ports such schemes—involving reclamation work, the construction of revetments, training banks and walls, sea and river walls—and other works, projecting into a waterway, are in progress, and much data, which can only be determined by surveys, is necessary to follow the course of such works in its effect upon the existing regime of the waterway.

A series of surveys, particularly if covering extended and periodic intervals, provide exceedingly valuable "comparative" records, apart from the actual hydrographic information afforded, to a Port Authority. The exact "means" of comparison, as by examination of a great number of survey plans, in order to obtain information in terms of accuracy, brevity and clarity, is somewhat difficult. A means of comparison which consists of prolonged and intensive study of past surveys, and, in cases in which these may easily amount to several hundreds in number from which a correct tabulation of all relative data therein must be extracted and correctly applied to subsequent factual developments, presents a complex problem. The presentation of comparisons of surveys is usually made by the super-imposition upon one another of innumerable outlines and contours, many of which frequently appear as contradictory and confusing, and from which it is consequently difficult to correctly appreciate the exact situation. By such means of comparison, however, it is possible to obtain a full general "picture" of the particular and adjoining waterways



Contour Index
Least width of Buoyed Channel, Indicated thus
Dry Contour " "
12 ft " " "
18 " " "

GRAPH OF PART OF A CHANNEL

Contour Index
24 ft Contour Indicated thus
Least navigable depth " "
Dredging " "

Hydrographic Graphs—continued

for correct determination of their relative effects upon each other. If comparisons are made by means of figures, these usually involve intricate calculations, which are difficult of mental absorption, and the necessary deductions to be made therefrom become progressively so.

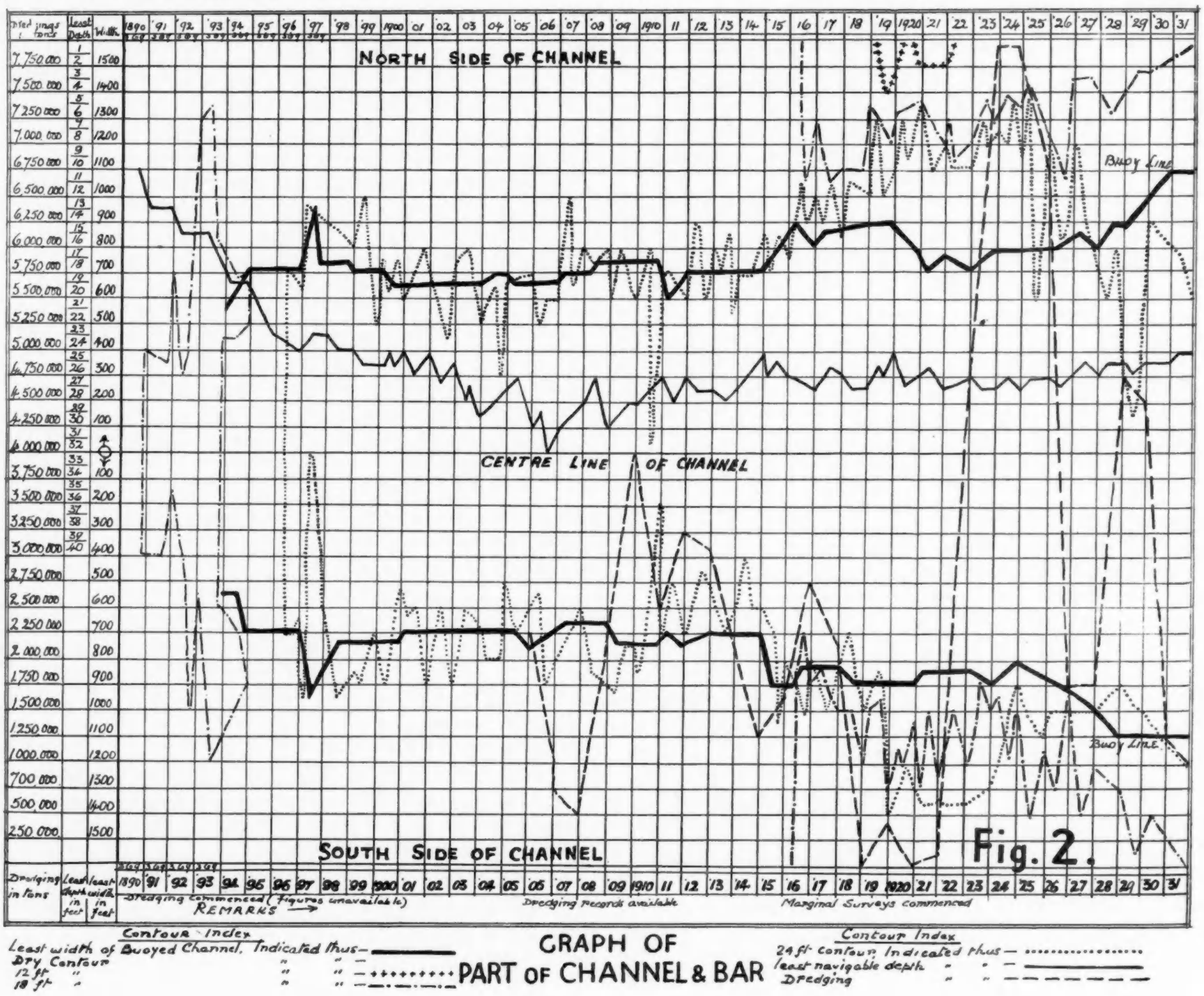
In the majority of cases, where the waterways of a port are liable to sudden fluctuations, etc., which require careful and constant observation, these occur in some particular position or positions in the waterway. It is these "critical" positions which require careful comparisons between the several surveys of such for the responsible port officials to keep conversant with all past, present, and as far as possible all future developments in these areas. For simplification of observation, and more particularly for ready reference, it is preferable for all data relative to these "critical" areas to be presented, whenever possible, in some distinctive visual form. It is also advisable to construct some form of permanent ready reference, or "history," of that portion of waterway, from which all particulars as to seasonal or periodic fluctuations, minimum depths, widths, marginal changes and other essential details are readily accessible.

This can best be accomplished by presentation of the above details in the form of a graph, which becomes easily understandable by even uninitiated persons. In connection with this latter point, it may be noted that it often *is* to persons indifferently equipped with technical conservancy knowledge that explanatory reports become necessary for presentation. Observation of a pictorial graph, embodying all relevant details, as supplied for its composition, by various surveys and augmentetd by other applicable features, enables a comprehensive picture of "cause and effect" to be seen. It should be stressed, however, that a graph, such as hereafter described, should be regarded as an adjunct to other forms of comparisons and not as a substitute therefor. Also that it constitutes a record, or history, of a certain portion only of a waterway and must not be mistaken for an entire channel, etc.

In the construction of a graph of a "critical" portion of a waterway, its scale will be dependent upon: the period of years over which reliable records of surveys exist; extent of fluctuations, to which subject; and to other features which may be considered as contributory to sudden effects or general alterations in regime. The chief purpose being, of course, the ability to present clear perception of all particulars, as may be required from time to time. Incidentally, it may be remarked that a graph serves a further useful purpose in making it possible to instantly and clearly refute any irresponsible statements as to conditions previously prevailing in a certain waterway, as prompt production of a graph effectually disposes of all further argument on the subject.

Fig. I.

This is a (very considerably) reduced facsimile of a graph of a portion of a sea channel leading into a certain port. This part



Hydrographic Graphs—continued

of the channel is subject to considerable shoaling and consequent variations in depth, and almost continuous dredging and frequent surveys are in operation in the locality. In addition, extensive construction of training banks and revetments took place over a period of several years in the region of its marginal limits with the object of achieving stabilisation of conditions, and the eventual abolition of dredging for other than occasional operation. The graph illustrates this " critical " portion of the channel wherein the minimum width of channel and shoalest depths have always been found, and will (it is hoped), upon reference to the footnotes, be found self-explanatory.

In studying the graph, it will be observed that in 1922 intensive dredging was put into operation to prevent further progression of the marginal contours towards the channel. The result of this dredging is visible in the recession of these contours and their reduction in area. In 1923 and 1929, the construction of two marginal training banks respectively commenced, and, as it continues and nears completion, a further recession of marginal contours is apparent, together with a considerable widening and consolidation of the 24-ft. contours of the channel. Slight shoaling is seen in the channel, from silt displaced by tidal action, under influence of the training banks. Surveys made subsequent to the completion of the graph show that this shoaling has disappeared.

Fig. II.

This graph is of a Bar at the seaward entrance to a sea channel into a port. In 1890, although buoyed, the least depth on this Bar was only 10-ft. (L.W.O.S.T.). Dredging commenced in 1891, but the quantity records of this dredging are unfortunately unobtainable. It will be observed that in 1898 the channel becomes established, with a minimum depth of 24-ft.

In 1922, as the result of the practical discontinuance of dredging of the previous four years, the channel shows severe deterioration and sharp decline in width.

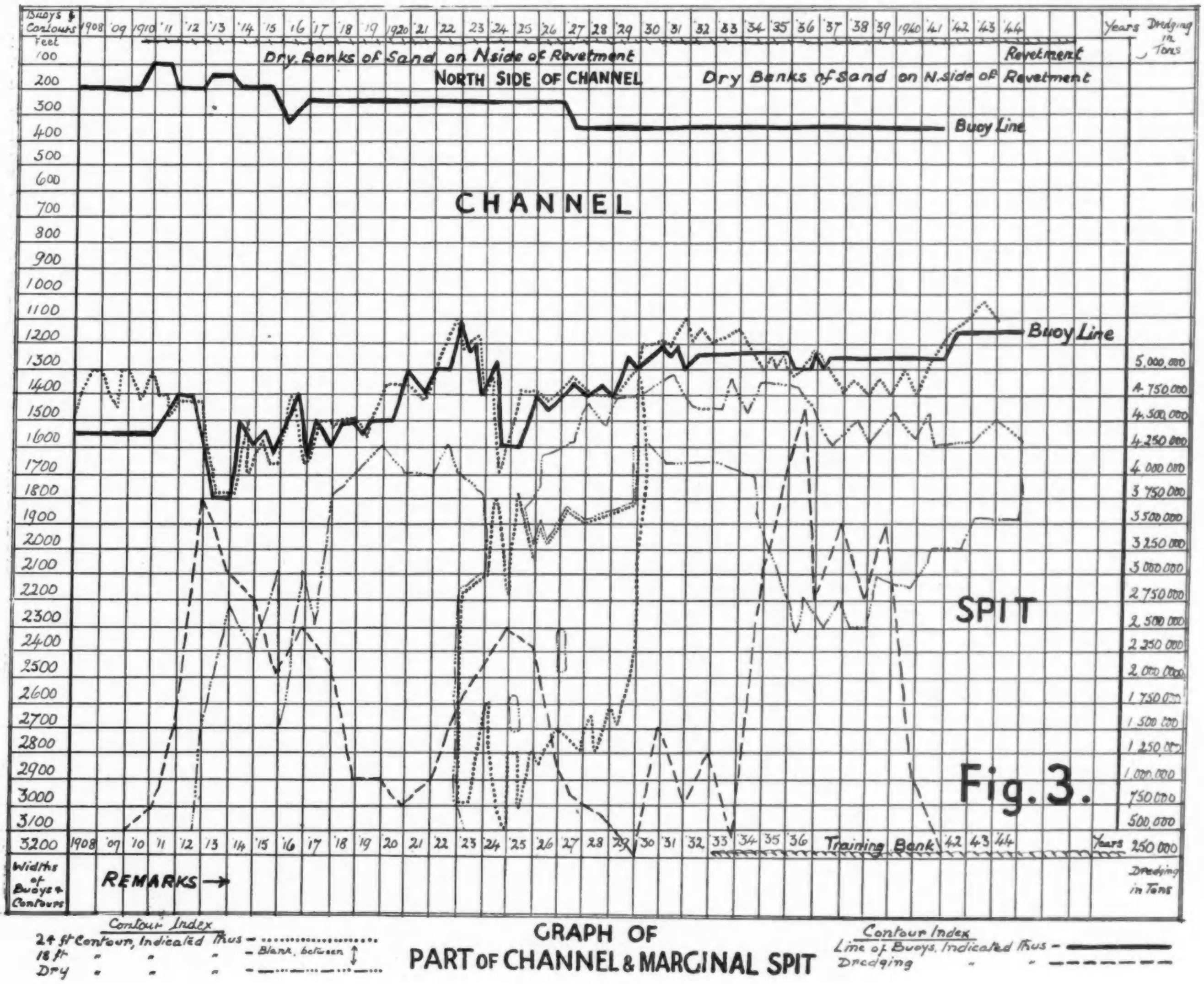
Intense dredging in 1923 immediately effected great improvement, with increased depth, widening of channel, and recession of the marginal contours.

The latter part of the graph shows deterioration in width and depth, consequent upon the cessation of dredging.

Fig. III.

This graph is of a portion of a bend in a channel formed by an extensive spit of sand. The opposite side of the channel is contained by a revetment constructed along outlying sandbanks. It is seen that, in 1908, the least width of the channel was 1,300-ft., which was increased by dredging. From 1917 and onwards, and with the decrease in dredging, deterioration began to take place, with the steady and considerable advancement of all marginal contours from the spit towards the channel.

In 1923 an inlet began to form and rapidly widened and deepened in its passage across the spit. This inlet began to close in 1925, with the further rapid advancement of all contours towards the channel. In 1930, the dry contour has reached its



GRAPH OF PART OF CHANNEL & MARGINAL SPIT

Hydrographic Graphs—continued

furthest limit in that direction, and there appears a slight recurrence of the inlet across the spit which, however, again rapidly disappears. In 1933, a general improvement commences, by which time the south training bank is completed sufficiently far across the spit to begin to exert its anticipated influence upon the regime of the channel.

This improvement is subsequently discontinued, probably because of the cessation of dredging and the sinking of the training bank, which latter no longer continues to act as an obstruction to the northward movement of sand across the spit and into the channel.

From the above explanations, therefore, it will be apparent that a graph possesses many advantages in its particular form of presentation of salient features, changes, and all the complementary data, of a portion of a waterway subject to fluctuations, and thereby necessitating careful and comparative observations. This presentation being in a form which is simple and easy of understanding to both technical and non-technical minds.

In these ways it has, at least, proved most useful in a certain port in providing readily accessible detailed information, as additional to other existing Conservancy records.

To Read the Graph:—

The lines of buoys, and minimum widths of channel, are measured laterally from the centre line of channel, and are read from the vertical column on the left side of the graph.

The minimum navigable depths in the channel are also measured from a parallel vertical column, and these depths extend horizontally across the graph.

The dredging quantities (for the sake of convenience) are drawn vertically on the graph and are shown in a similar vertical column. All information is given to the nearest three months in each year. As an example:—Graph I, end of 2nd three-monthly period in 1921.

Width of channel between buoy lines	=2,100-ft.
Width of channel between 24-ft. contours	=1,200-ft.
Relative positions of other contours	=advancing on W side. receding on E side.
Minimum depth in channel	=23-ft.
Dredging quantities in that year ...	=1,250,000 tons

Remarks:—

W Training Bank commenced.

The dry patch on W side of graph has disappeared.

International Labour Organisation

Study of Dock Labour and Inland Transport Problems by the Inland Transport Committee

The Inland Transport Committee is one of several Industrial Committees set up by the I.L.O. in 1945 as a medium for the study of the labour problems of international industries, including inland transport.

The Third Session of the Committee was held in Brussels from 17th to 27th of May last, the Agenda consisting of four Reports. It is pointed out that these four Reports have been prepared by the International Labour Office as a basis for consideration by the Inland Transport Committee.

Report I. General Report. The matter covered in this includes a survey of progress made in various countries in respect to the resolutions adopted at the second session of the Inland Transport Committee, action taken on resolutions concerning Studies and Reports, an analysis of recent developments in the field of Inland Transport, i.e., Railways, Roads and Canals, together with a list of a number of other subjects of interest to the Committee.

Report II., which deals with Decasualisation of Dock Labour is printed in an abridged form at the end of these notes.

Report III. is devoted to the Protection of young workers on Inland Waterways, and submits, for consideration by the Committee, information on the present status of such young persons, including age of entry for employment, medical examination and standards, hours of work, rest and holidays, official inspection and supervision, schemes of education and vacational training, particularly in regard to boatmen's children.

Report IV. is based generally upon the answers from transport undertakings and trades unions of various countries sent by them to the I.L.O. in respect to origins and aims of technical selection of workers not only as a means of ensuring the safety of workers and public but as a means of ensuring the effective utilisation of available man-power, by filling each post with the worker best qualified for it by his capabilities and experience.

Report II. Decasualisation of Dock Labour (Abridged)

It is common knowledge that the employment of dockers tends to be casual. How to decasualise it and to provide the men with regular employment at reasonable wages is a problem which has engaged the attention of Governments, ports authorities, employers, trade unions, sociologists and publicists for many years.

The principal reason for the casual nature of employment in dock work resides in the wide fluctuations of port traffic. Because of these fluctuations the contrast in work opportunities varies between two extremes. There may be days when there is not a ship in port and not a man at work, and others when the harbour is full of ships and all the available men are working, even on overtime. The crux of the problem of regularisation of port work is how to maintain a sufficient reserve of labour and yet avoid a surplus resulting in under-employment during periods of normal or less than normal port activity.

Opportunities for employment in dock labour, besides being influenced by the wide variations in the number of ships entering and leaving port, are also dependent upon many changing factors, and to complicate matters further, unemployed persons from other industries and areas are induced—by the relatively high hourly earnings and the chance of receiving a temporary job—to seek employment in non-decasualised ports in competition with those who are regularly dependent on dock work for their living. Accordingly, conditions encourage the presence of a surplus of labour at the ports, which may in some cases be considerable; it may indeed exist not merely during unusually slack periods but at all times except those of the most intense activity.

Decasualisation has not always been regarded as an economic necessity from the point of view of the efficient working of the ports. Where man-power is ample there may be no serious difficulties for the port authorities and the port employers. In such cases there is always a sufficient number of experienced men available to enable the cargoes to be handled with skill and despatch, and there is therefore no need to maintain a sufficient and suitably composed labour force by providing the men with regular jobs. There is accordingly no great incentive to embark upon schemes of decasualisation in countries in which labour is abundant or in periods of unemployment. It is therefore not surprising that relatively slow progress was made towards a solution of the problem during the years of depression which preceded the Second World War.

When the question of decasualisation was first ventilated it was put forward as a social problem. Casual labour was described as an evil which should be removed in the interests of society as a whole. It affected not only the working conditions of the docker but also his outlook on life. The insecurity of his employment and the irregularity of his income produced effects which were felt in the home; they influenced both his material standard of living and the social status of his family. The whole system, it was said, had consequences of grave concern to the community.

That dock labour should not necessarily remain casual needs no longer to be proved. It can be and has been decasualised in a great number of ports throughout the world. The methods designed to achieve regularisation of port employment may vary

International Labour Organisation—*continued*

in detail because of the varying conditions obtaining in different countries and in different ports, but the essentials have been substantially the same everywhere.

Though the necessity for providing regular jobs may not make itself felt when ample labour is at call, it is clear that the problem may take on a different aspect when man-power shortages occur. Such a shortage arose in the United Kingdom during the Second World War, and it then became necessary for the Government to take special precautions for ensuring the supply of labour to essential industries, including the port transport industry. It was this need which led to the introduction of the first comprehensive schemes for the decasualisation of dock labour in that country. Other countries, too, as already indicated, now have schemes from which useful lessons can be drawn.

The war-time schemes in the United Kingdom have been replaced by the Dock Workers (Regulation of Employment) Scheme, 1947, the objects of which are "to ensure greater regularity of employment for dock workers and to secure that an adequate number of dock workers is available for the efficient performance of dock work." It will be seen therefore that the decasualisation of dock labour in the United Kingdom, which was first advocated as a measure of social justice for the dockers, has been brought about not merely in order to solve an acute social problem, but also as a means of ensuring a sufficient supply of labour for the ports.

Since the introduction of a decasualisation scheme may involve a reduction in the number of men employed from time to time in the ports, it should be easier to launch such a scheme when fewer men are regularly seeking work. The present period of man-power shortages in many countries offers therefore a challenging opportunity for providing "greater regularity of employment for dock workers."

Measures Concerning Regularisation of Employment.

Some limitation of the number of dockers competing for work is a first basic measure towards the regularisation of port employment and is therefore included in all decasualisation schemes. The methods used to reduce the labour force to the level required are much the same in different countries and ports. They consist simply of granting to a certain number of workers a priority right to take up employment as dock workers in the port concerned. These workers are registered and provided with identity cards or other means of identification to be shown when they are reporting for work. However, simple as the question of restricting the competition for work may be in principle, it involves certain problems which require satisfactory solution and which, in the light of experience, have proved difficult.

Registration.

Restriction of the competition for work implies that certain workers have a priority right to employment in the port concerned. As the number of these regular workers may not be sufficient, provisions in this regard are usually to the effect that persons who are not registered as regular dock workers are not allowed to take up employment in a port until all the regular workers have been allocated to work. There are, thus, two groups of workers, regular workers, with a priority right to employment, and casual workers.

This differentiation can evidently be carried further, and systems with two priority groups are not unusual, under which the members of the second priority group are allocated to work after all the workers with first priority but before any other workers. The reason for such further differentiation is probably to be found in the fact that, with a system of only one priority group of regular workers, there is likely to be, among the casual workers, a group of persons seeking employment as dock workers fairly regularly. It is from this group—which will be larger in proportion as the number of regular dock workers is restricted—that regular dock workers are normally recruited, and it has been the practice to grant them priority right to employment before other casual workers. In the Port of Antwerp, for instance, a second priority group of dock workers called "candidate" dock workers has been established.

Determination of the Number of Regular Workers.

The number of regular workers should be great enough to secure an efficient turn-round of shipping; on the other hand, it should be so restricted that each worker is secured an amount of work sufficient to provide him with a fair income. These two objectives, which are the main concern of all decasualisation schemes, are not easy to combine, and the greater the fluctuations in employment the more difficult the problem becomes. The number should obviously not exceed that required to meet any peak of employment which can reasonably be expected to occur during the period for which it is to be determined, but even then it may be too great to allow a sufficient amount of work to each worker during the period concerned. To the extent that the amount of work available for each worker is too small to provide a living wage, it will be necessary to reduce the number of regular workers, with the result that casual labour has to be resorted to during rush periods.

There are thus certain factors of primary importance which have to be considered when determining the number of workers to be employed on a permanent basis, namely, the volume of work and its variations, wages, and the desired income standard of the workers. While the latter are normally matters of collective bargaining, statistical research is required for a proper idea of the volume of employment, its trends and short-time variations, and the way these variations affect the employment of regular workers.

Recruitment and Selection of Regular Workers.

Normally the recruitment of regular dock workers does not raise any special problems. They are recruited, as a rule, from among casual workers who have already gained a certain knowledge of the industry and who are also often known to the foremen allocating them to work. However, one aspect of recruitment deserves special attention, namely, that of technical selection. Dock work is particularly strenuous, and it has been suggested that it would be well for the industry as well as for the workers themselves to make sure that those who are engaged on a permanent basis possess the required physical capacity. Medical examination of the workers has become a regular practice in certain countries. For instance, in Australia, each applicant for registration as a regular dock worker has to undergo a medical examination. The same applies to the so-called "candidate" dock workers in the Port of Antwerp.

Reduction of the Number of Regular Workers.

Several means of bringing about a reduction in the regular labour force are practised. Dismissals as a means of reducing the permanent labour force are generally opposed by the trade unions, which object to having their members put out of jobs. This attitude is particularly strong in decasualised ports, because workers' representatives usually take part in decisions on questions relating to the recruitment of regular workers and thus feel a responsibility for their employment, and short-time work has been more or less regarded as normal and the workers have become used to sharing employment opportunities during slack periods.

In the British decasualisation scheme, the possibility of dismissing workers in order to reduce the regular labour force has been left open. During the discussions preceding the introduction of the scheme, certain trade unions suggested that reductions should only be effected by stopping recruitment until the necessary reduction had been effected by natural wastage, but this proposal was not accepted, as being too "slow and inefficient."

The Australian scheme restricts dismissals as a means of reducing the labour force to the point where the number of workers required for the proper and effective conduct of stevedoring operations is likely to remain for an indefinite period less than the number of permanent workers registered. This refers also to temporary dismissals. Moreover, before dismissing workers under the Australian scheme it must be proved that the workers concerned are unable to be registered for employment at some

International Labour Organisation—*continued*

other port. No dock workers may be dismissed who, immediately before the introduction of the present scheme (Stevedoring Industry Act, 1947), were members of the Waterside Workers' Federation of Australia or were registered as regular dock workers.

Under the French scheme, regular workers have to be given one month's notice before being dismissed.

In certain ports for example, Stockholm and Goteborg, it has been the practice not to resort to dismissals in order to reduce the number of workers, but to stop recruitment of new workers until the necessary reductions have been brought about through natural wastage.

During the Second World War, when there was a considerable drop in employment in the Swedish ports, it was usual for permanent workers to be released for a certain period of time from their obligation to report regularly for work, thus enabling them to take up other employment. This has become a regular practice since 1946.

Recruitment of Casual Workers.

The measures of decasualisation which have so far been discussed have primarily concerned the regular workers. In most decasualised ports, however, casual workers are needed in periods of particularly high demand for labour. Often, in fact, the proportion of casual workers is by no means negligible. In the Swedish ports, for instance, only 70 to 75 per cent. of the work is carried out by regular workers with first priority for employment.

In the casual labour force, certain groups can be distinguished for whom the casual character of the work is no special disadvantage, namely, those who take up dock work from time to time as a means of supplementing their income and those who take it up temporarily while waiting for other work.

As to the first category, it may be possible to register those persons who are willing to take odd jobs in the port and who can be called upon in case of need. Co-operation with the public employment service is another approach to the problem. Such co-operation can also help to ensure fuller and more effective use of local labour resources. Methods of co-operation with the public employment service have been successfully applied in Swedish ports. In 1946, co-operative arrangements with the public employment service were extended to all Swedish ports, and it was agreed that casual workers for the port transport industry should be recruited primarily through the public employment service.

Central Allocation to Work.

In non-decasualised ports, dock workers are generally engaged in the following way: a number of men assemble at a specified place at a given time, and the foremen select from among them individual workers and thus collect a labour force large enough to meet the port requirements for the next several hours. This method of engaging workers is known in Great Britain as "calling on" and in the United States as "shape up"; it may take place at the employer's office, in a "hiring hall," at a "call stand" in the open air, at the dock gates, or alongside the ship.

Wherever this procedure is followed, certain workers habitually seek employment in one part of the port and other workers in another. There are several reasons for this tendency—force of habit, nearness to home, knowledge of employers and foremen, preference for the kind of work to be done, ignorance as to whether employment is to be found elsewhere, and so on.

These factors tend to make the man-power of the port transport industry somewhat immobile and to create a surplus of men at one point and a scarcity at another. Hence, in order to meet the eventuality of a shortage, individual employers in unregulated ports find it useful to have a maximum reserve available. Moreover, some employers specialise in handling certain kinds of cargo and therefore wish to employ men who are accustomed to their particular type of work, and naturally wish the men they usually employ to be on call whenever they are needed.

Fluctuations in the volume of traffic, and hence in employment, are likely to be greater in each of the port districts than in the port as a whole, and result of the lack of co-ordination in the placement of workers is that the total labour reserve required necessarily exceeds that which would have been sufficient if the engaging of workers had been organised with regard to the needs of the whole port.

The conclusion to be drawn from the above must be that a centralisation of the engaging of workers within each port will help to reduce the labour reserve and thus provide more regular employment for the men available. Central despatching has in fact been applied in every port where decasualisation has been successfully carried out.

The transfer of workers between ports in cases where a rush of work in one part coincides with a slack period in another is only an extension of the co-ordination of employment in one and the same port. Transfers of this kind were frequently made during the Second World War, when it was particularly essential to make the best possible use of each individual worker. In the present decasualisation scheme of Great Britain there is a special provision for securing such transfers where they are deemed appropriate. Under the scheme, a worker is obliged to accept employment at any port within daily travelling distance of his home.

Concentration of Shipping in a Smaller Number of Ports.

The effects which can be expected from co-ordinating the engaging of workers for several ports suggest a more radical measure, namely, that of concentrating shipping in a smaller number of ports. Several advantages may be obtained in this way. The possibilities of co-ordinating the employment of workers will obviously be improved; employment will tend to be more stable with the greater volume of traffic; and the establishment of larger ports will justify further investments in equipment, thus heightening the efficiency of the work. However, it is obvious that economic factors, mainly costs of inland transport, and the existence of adequate transport facilities, limit the possibility of reducing the number of ports. There are also the serious objections from local traders and the resistance from workers who would either have to find other employment locally or move to another town. Attention must also be paid to the cost of laying idle the facilities which have been developed in the ports.

Training of Workers and Supervisors.

Central placement and transferring of workers between ports both aim at making available a greater volume of employment to be shared collectively by the dock workers, thus helping to provide the conditions for more stable employment. A further reduction in the number of men required can be obtained by breaking down the barriers caused by the inability on the part of groups of workers to carry out certain operations. In view of the variations in the number, size and equipment of ships and in quantities and types of cargo, there is, in port transport, a particularly great need for transferring workers between different types of operations. Systematic training of the workers and their supervisors will help to bring about these ends. By adding to efficiency, training will also contribute to a reduction in total man-power requirements.

Reference may be made in this connection to the British Dock Workers' Scheme, 1947, in which the training of dock workers is especially mentioned among the responsibilities of the National Dock Labour Board, which is charged with the central administration of the Scheme. In the Port of Antwerp, courses ending in regular examinations are arranged for specialist workers. Training of supervisors in the port transport industry has been carried out in the United Kingdom under the Training Within Industry Programme and in Sweden at the Institute established by the Association of Swedish Industries for the purpose of training supervisors.

Introduction of Labour-Saving Equipment.

If the output per worker in terms of handled cargo is increased, this will enable a reduction in the total labour force, and accordingly a proportionate reduction in the man-power reserve to be made. With regard to the introduction of labour-saving equipment, a certain amount of opposition was previously shown

International Labour Organisation—continued

from the rank and file of workers in all industries, although a considerable change in this attitude has taken place in recent years. The following statement on the subject was made in a report of the Working Party on the Turn-Round of Shipping in the United Kingdom Ports.[1]

We found that port authorities and other employers, and the trade unions, were agreed that in principle increased mechanisation was desirable. In practice, however, its development is hindered by the unwillingness of some employers to invest capital in plant on which they believe, for various reasons, they will not obtain a reasonable return, and by the longstanding prejudice of some of the men against any innovation which, if it is to be effective, must reduce the number of men required to perform a given operation.

A pre-requisite to increased mechanisation is, therefore, to establish confidence among port authorities and other employers that machines purchased will be efficiently and economically used, and among the men that such machines will genuinely improve their conditions of work.

Welfare Measures.

Measures to promote the welfare of the workers are generally recognised within different industries as being of great importance in maintaining a stable labour force, but progress within the port transport industry in this respect has been slow as compared to other industries. This may be attributed partly to technical difficulties, but also—and mainly—to a failure to organise employment rationally within this industry.

Under the Stevedoring Industry Act, introduced in 1947 in Australia, provision is to be made for canteens, dining rooms, rest rooms, and adequate sanitary and washing facilities for waterside workers. The French scheme contains a general clause to the effect that the central employment office established in each port is responsible for taking all necessary measures to ensure that each worker shall benefit from existing social legislation. The British National Dock Labour Board is required to make "satisfactory provision for the training and welfare of dock workers, including port medical services, in so far as such provision does not exist apart from the Scheme." Under the New Zealand scheme, provision is to be made for amenities for dock workers, including waiting rooms, restaurants and canteens. Grants are to be made to sick benefit societies, hospital comforts funds, sports clubs and other societies and funds established for the benefit of dock workers.

Central Payment of Wages.

In most decasualised ports, provision is made for a central payment of wages. This relieves the workers from the time-wasting procedure of visiting each employer for whom they have been working in order to collect their wages for the previous pay period. Where a system of guaranteed wages is introduced, central payment is indispensable for the proper control of its administration.

Centralised payment of wages obliges employers to send individual returns of wages to a central pay office and to pay the wages into a central account. There seems some reason to presume that such a procedure would also simplify the work for the employers.

Measures Concerning Stabilisation of Earnings.

Short-time work implies that the available work is shared among a larger number of workers than would have been necessary had each worker been fully employed. It is used in different industries as a means of preserving the labour force through slack periods which are expected to be temporary. In port transport, with its perpetual fluctuations in employment short-time work is specially prevalent. The distribution of the work available in such a way that all the workers, so far as practicable, may secure the same earnings, is generally known as equalisation of earnings.

[1] (London, H.M.S.O. 1948)

Guaranteed Minimum Income.

Most of the recent decasualisation schemes, for instance, those introduced in Australia, France, Great Britain and New Zealand, include provision for a guaranteed minimum income for the regular workers. Such a guaranteed minimum, which is conditional on the men's reporting regularly for work, has two objects, first, to provide economic security for the workers, and secondly, to recompense the workers for agreeing to report. These two purposes are most clearly discernible in schemes—for instance, those operated in Great Britain and New Zealand—under which the guaranteed payments include both attendance money, payable to those reporting for work should no work be available, and a guaranteed weekly wage exceeding the highest possible sum of attendance money. The difference in character of these two types of payment is made clear by the fact that attendance money is paid irrespective of other earnings during the week concerned, while the guaranteed weekly wage is payable only in so far as it exceeds the total weekly earnings from dock work, including attendance money.

Under the British scheme, attendance money is paid to permanent dock workers in respect of each ordinary turn (eleven turns per week, one on Saturdays) subject to certain hours and overtime restrictions, for which they report and are available for work, but are not allocated to work.

In New Zealand ports, permanent workers belonging to the appropriate trade union (New Zealand Waterside Workers' Industrial Union) are, subject to their reporting for work, guaranteed work on each day, Mondays to Fridays inclusive, to the value of two hours' ordinary time general cargo rate of pay or, failing provision of such work, are entitled to be paid that sum.

Similar provisions are introduced in Australian, Belgium and French ports.

In Belgian ports, attendance money is granted to dock workers who present themselves for work without being employed. This attendance money, which is calculated per day, is made up of unemployment benefit plus an additional sum paid out of a special fund.

Under the French decasualisation scheme, attendance money is payable for each turn (two turns a day) for which the workers report for employment without being allocated to work. The number of turns for which attendance money is payable is limited to one hundred during a period of six months, unless special regulations on the matter have been issued with regard to the port concerned.

Weekly Wage.

As already stated, both in Great Britain and New Zealand the guaranteed weekly wage exceeds the highest possible sum of attendance money, but all earnings from work, together with attendance money, are counted against the guaranteed weekly payment. The British provisions in this respect are as follows:

All earnings for work, whether piecework or time work, including overtime, performed between midnight Sunday (or the commencement of the Sunday night shift) and normal finishing time on Saturday, together with any attendance money . . . and any payments made in respect of holidays, shall count against the guaranteed weekly payment.

The fact that all earnings are to be counted against the guaranteed weekly payment largely arises from the view that the only purpose of this payment should be to secure the workers a certain minimum income.

Scope of Decasualisation Schemes.

A question of vital importance is that of determining the extent of decasualisation schemes, both geographically and with regard to different classes of work.

Geographical Scope.

The decasualisation of dock work has passed its experimental stage, characterised by isolated attempts, more or less successful, to regulate employment in individual ports, and decasualisation schemes providing for a certain degree of uniformity with

International Labour Organisation—continued

regard to the measures to be taken are now being introduced more and more frequently on a nation-wide or area basis, by means of special legislation or collective bargaining or both. On the other hand, in view of the nature of the problems which have to be solved, all such schemes provide for the establishment of local bodies entrusted with a certain measure of autonomy.

In Australia, the Stevedoring Industry Commission has been set up to deal on the national level with questions relating to "the speedy, safe and efficient performance of stevedoring operations; the provision of sufficient waterside workers for stevedoring operations; and the use of the labour of waterside workers to the best advantage." The Commission may assign any of its powers or functions to a local waterside employment committee which may be set up in respect of any port.

In France, the National Dock Workers' Guarantee Fund has certain functions which are essential for the proper working of the decasualisation scheme, while other functions are assigned to local dock labour boards.

In Great Britain, the National Dock Labour Board has been established, the functions of which include all such activities and operations as further the objects of the scheme, which are to ensure a greater regularity of employment for dock workers and to secure that an adequate number of dock workers is available for the efficient performance of dock work. Local Dock Labour Boards, responsible to the National Board for matters of local policy and administration, are established for each port or group of ports.

In New Zealand, the Waterfront Industry Commission is responsible for the regulation, control and performance of waterside work on the national level, while the local administration is entrusted to local port committees.

In the United States, unified machinery for the regularisation of port employment on the Western seaboard has been established by agreement between employers and workers. This machinery covers practically all the important ports of the region, and consists of port joint committees operating under the direction and control of a single joint coast committee.

As regards the need for initiative and decisions on the national level, it is interesting to note that in Sweden, where no special body has been established for this purpose, meetings have been arranged with representatives of the parties concerned at which important decisions on national policy have been taken.

Structure of Decasualisation Schemes

Experience varies from country to country as to the extent to which legislation has been found necessary for regulating the employment of dock labour. Generally speaking, wherever solutions to this problem have been sought, the first attempts to decasualise port work were made by the parties themselves, through the machinery of collective bargaining and without the intervention of the State. However, a considerable number of countries have been led to legislate on the matter, particularly in recent years.

In the United Kingdom, the first voluntary agreement to regulate the number of dock workers in a port and to systematise the method of engagement was made in Liverpool as early as 1912. The system of registration was gradually extended to other ports, and by 1939 voluntary registration schemes had been set up in most of the principal ports of the country.

The joint committees which operated these schemes seldom succeeded in keeping the register in close relation to the requirements of the ports, and at the outbreak of the Second World War, when the problem of the best distribution of manpower became all important, the first compulsory measures were introduced, and were later expanded into comprehensive regulations covering a large part of the conditions of employment of port workers.

In the United States, on the other hand, the system of decasualisation of port labour has remained firmly anchored to the principle of collective bargaining, and the regulations concerning the engaging and despatching of longshoremen are included in the collective agreements.

Whatever the nature of the scheme, whether it is based on a voluntary agreement or on statutory regulations, the principle generally followed is that the costs involved in operating it must be met by the industry itself. This is the case in all the countries especially mentioned in this report, although the technical arrangements vary.

The very nature of the decisions which need to be taken in connection with the operation of a decasualisation scheme suggests the necessity of a close collaboration between employers and workers. No system of registration, no machinery for the allocation of jobs to workers or for the determination of the number of regular dockers could work properly without such collaboration. For these reasons decasualisation schemes, whether based on voluntary agreements or on statutory regulations, generally provide for an equal representation of employers and workers on the national and local administrative bodies.

CONCLUSIONS

It will have been observed that a fair amount of experience has now been gained in various countries, both in the working or arrangements which help to reduce casual labour and in the operation of schemes for full decasualisation. The experience covers steps taken by voluntary agreement between employers' and workers' organisations as well as compulsory measures introduced by legislation. Nor is there any lack of documentary material.

Numerous enquiries into the question of decasualisation have been held, with the result that the problems connected with the introduction and administration of decasualisation schemes have been carefully examined and explained. The reports of these enquiries throw light on the methods which may be adopted for dealing with the problems. They also describe and examine the views put forward by the employers' organisations and trade unions.

It may be said that the main purposes of decasualisation schemes are to provide greater regularity of employment for dock workers and to ensure that there is an adequate supply of labour for the efficient performance of the work. Accordingly, decasualisation involves limiting the number of men employed—or registered for employment—in the ports in such a way as to ensure that those entitled to claim a share of the work are not too numerous for the scheme to carry. On the other hand, the number of registered men must not be too small. It would be no solution to provide permanent employment for a limited number of men if this meant creating more unemployment or underemployment for the others. There must be sufficient though no more than sufficient—men available to carry out the work.

The problem before the Committee is to consider the methods by which the difficulties may be overcome. Do the existing schemes provide a satisfactory basis for the introduction of further schemes elsewhere? Can decasualisation be brought about on broadly similar lines in all countries? Is it possible to advance towards decasualisation by stages and, if so, what are the intermediate measures which should be taken

If it is to answer these questions, the Committee may find it useful to analyse the difficulties which have to be overcome and to examine the experience already gained in the operation of decasualisation schemes. It may then be able to suggest the lines on which decasualisation schemes might be organised in countries which have not so far introduced them.

It would seem that the problem of decasualisation presents different aspects in different countries, and that possibilities for dealing with it may vary according to the manpower situation, the extent and nature of the trade of the ports, the impact of seasonal changes and other factors. Again, the methods which could be adopted may be influenced by the stage of social development in the various countries, by their degree of administrative and economic organisation, by their traditional practices in the handing of labour problems, and so on. Experience would appear to have shown, however, that decasualisation schemes can be administered without regard to the form and nature of the port authorities, since they may be organised and financed on a completely autonomous basis.

An essential requirement for the success of decasualisation schemes is to secure the co-operation of port employers and

International Labour Organisation—continued

workers. It should not be assumed that the workers are unanimously in favour of decasualisation and that the employers are not interested in it. There are, in fact, many well-founded objections to decasualisation schemes, and the objections are not all on one side.

Points for Discussion.

In view of the foregoing examination of the problem, the Committee might find it useful to take the following points into consideration during its discussion.

I. Measures concerning Regularisation of Employment.

1. Desirability of limiting the competition for work in port transport by means of:
(a) establishing registers of dock workers, adjusted so as to ensure the efficient turn-round of ships and to provide regular dockers with a sufficient amount of work;
(b) granting priority right to employment in port transport to those who are registered as regular workers; and
(c) establishing a system of allocation to work which will secure equal opportunities of employment for the regular workers.
2. Organisation of adequate statistical research into employment in port transport and the factors affecting this employment.
3. Establishment of registers of persons who might be available for casual employment in port transport in emergencies and who are not dependent on dock work for their existence.
4. Collaboration with the public employment service for the recruitment of casual workers for employment in such emergencies.
5. Establishment in each port of a system of central allocation of dock workers to work.
6. Facilitation of the transfer of regular dock workers between ports.
7. Organisation in co-operation with the public employment service, of a system for the temporary placing of regular dock workers in other employment should opportunities for employment in dock work be scarce.
8. Arrangement for adequate training of dock workers and their supervisors.
9. Introduction and carrying out of comprehensive programmes with a view to raising the standard of welfare of workers in the port transport industry, particularly by the provision of adequate waiting-room accommodation and canteen facilities.
10. Provision in each port for the central payment of wages to dock workers.

II. Measures concerning Stabilisation of Earnings.

11. Provision for a system of guaranteed payment to regular dock workers.
12. Desirability of including in guaranteed payments:
(a) a guaranteed payment in respect of each day or shorter period for which the workers are required to report for work (attendance money);
(b) a guaranteed weekly wage.

III. Scope for Decasualisation Schemes.

13. Desirability of giving wide geographical scope to such programmes.
14. Introduction, in countries with a port transport industry, of national or area schemes for the stabilisation of employment in this industry.
15. Desirability of making such schemes applicable to all classes of work in port transport in which employment is casual.

IV. Structure of Decasualisation Schemes.

16. Desirability of appointing national or area and local bodies for the administration of measures to stabilise employment in port transport.
17. Appointment on these bodies of equal numbers of employers' and workers' representatives.
18. Co-ordination of the activities of the administrative bodies appointed for the stabilisation of employment in the port transport industry with the activities of other bodies concerned with the proper functioning of this industry.

Review of the Work of the Sub-Committee (of Inland Transport Committee)

By D. F. MACDONALD, M.A., D.Phil.,
Secretary of the National Association of Port Employers*

The three main subjects for discussion at this third session of the Inland Transport Committee were:

(i) technical methods of selection of workers;
(ii) the protection of young workers on inland waterways; and
(iii) decasualisation of dock labour.

In accordance with the usual procedure, each of them was referred to a Sub-Committee, equally representative of governments, employers, and workers.

In regard to the first, it was decided that as the application of technical methods for the selection of workers is still, in general, in the early stages of development, it was necessary to acquire more information on the position as a basis for future consideration by the Committee. The Sub-Committee dealing with the second item presented a comprehensive Resolution urging in particular a minimum age for entrants, medical examination of recruits, provision for rest periods, annual holidays with pay, and where necessary, special educational facilities for young workers.

The subject of particular interest to the Port Transport Industry was, of course, the decasualisation of dock labour. In all, seventeen nations were represented on this Sub-Committee. In suggesting points for examination, the International Labour Office had, naturally enough, drawn on the experience of the most advanced schemes already in existence, notably that in the United Kingdom. The first fact that emerged from discussion, however, was that those schemes could not and should not be put forward as models for the rest of the world. It was appreciated that they were comparatively new and even in some respects experimental, and were not to be regarded as necessarily constituting the final solution to the problems of the nations concerned. Still less could they be accepted as prototypes for other countries whose social and economic background might be very different. The diversity of the problem, viewed internationally, and the comparative lack of knowledge of the national problems, made it in fact undesirable, even if it were possible, for the Sub-Committee to attempt to propound solutions in any detail. In any case, as was evident from discussion of several of the points put forward by the office, a detailed approach would have raised very contentious issues, both nationally and internationally; for example, the form of administration of any dock labour schemes, and the shape of guaranteed payments, if any. It was accordingly agreed that the Sub-Committee must confine itself to the study of what could be considered fundamental principles. It is notable that even so, the Scandinavian employers felt constrained not to vote in support of the final Resolution.

It was indeed a somewhat remarkable achievement, and a testimony to the moderation of all the parties, that with so vast a variety of practice and outlook in the different countries, it proved possible for the Sub-Committee, after much debate, to embody in an agreed Resolution a set of definite principles, however hedged around with reservations and qualifications.

The Resolution affirmed the need, as a first step towards the greater regularisation of employment (it was agreed that "decasualisation" was a misnomer, since dock work cannot in fact be wholly decasualised), that there should be registration of workers—a principle accepted in the United Kingdom as far back as 1912, in Liverpool, but only nationally applied during the late war. Along with this there should go a system for the regulation of the engagement of workers, designed to give equitable (but not necessarily equal) opportunities of employment, with due regard

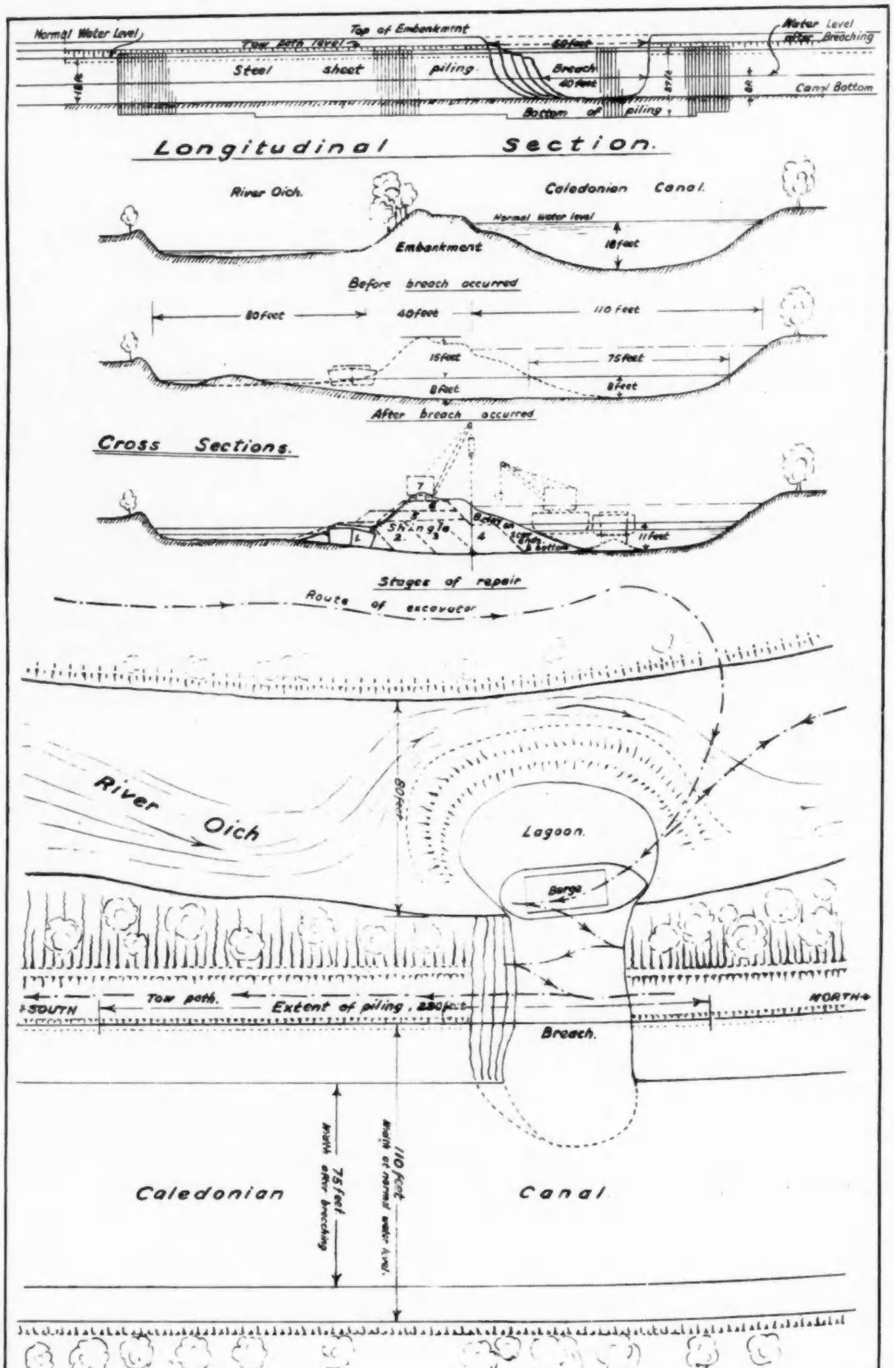
(continued on page 94)

*Mr. MacDonald, as Employers' Vice-Chairman on the Sub-Committee, was spokesman for the International Employers, and their representative on the Drafting Committee.

The Repair of a Breach in the Caledonian Canal Embankment, 1947

By FRANK WHYTE, O.B.E., M.C., B.Sc., M.I.C.E.

On the evening of 11th August, 1947, a breach suddenly occurred in the embankment, which forms the west side of the Caledonian Canal and the east bank of the River Oich, at a point about three miles south of Fort Augustus, the water pouring out of this two mile reach of canal into the river through the gap, which finally widened to about 40 feet at river bed level.



By the following morning, the flow had ceased, the canal water level, between Kytra and Cullochy Locks having dropped (by about ten feet) to that of the river water, which was very low at the time owing to prolonged drought. The flow through the breach had scoured out the foundation of the embankment to approximately the same depth as the bottom of the canal which, at this point, is about eight feet lower than the river bed. The depth of the canal here is normally between 17 and 18 feet, the top of the embankment being about five feet above canal water level.

The embankment consists of sandy clay, founded on morainal gravel and boulders, and the canal is lined with clay to render it watertight. About 2,400 cu. yds. of material had been washed out of the embankment and most of it had disappeared down the river in the form of silt, leaving only a semi-circle of shingle and boulders round a lagoon which had formed in the river bed.

The breach had occurred in a most awkward and isolated place, and in difficult country, the main road being one and a half miles distant. The greatest care would have to be taken not to disturb the existing canal embankment, when carrying out the repair. Owing to the low state of the river, there was no immediate danger of further erosion taking place, although the scar ends of the embankment might slip, one end being nearly vertical. But if the river should rise (as it can do rapidly when there is rain on the surrounding hills), extensive damage might be caused to the breached embankment, by the flow of the river which has, at times, risen higher even than the normal level of the canal.

It was, therefore, essential that the breach should be filled with hard material, without delay, and a good toe formed at the river side of the embankment. The problem was where to obtain the material, how to place it in the gap without damaging the embankment, and how to effect a watertight seal.

It looked at first as if it might be necessary to transport shingle or road metal from a considerable distance by lorry, first making a temporary road from the main road, and forming a dump of material to the east of the canal from where it could be conveyed by aerial ropeway across the canal and tipped into the breach, thereafter making it watertight possibly by chemical consolidation. Such methods would have been slow and costly.

The possibility of forming a coffer-dam of sheet piling was also considered but pile driving in the waterlogged gap was an awkward proposition without support for the piling plant, and the vibration of driving piles for a gantry, at this stage, might have caused further damage to the embankment.

A quick reconnaissance was therefore made, and it was found that there were considerable areas of shingle in the river bed which might yield the necessary material if only the water could be kept low enough.

The River Oich obtains its main supply of water from Loch Oich, which forms the summit level of the Caledonian Canal, and steps were taken to reduce the already low level of this lock by running off water from it into Loch Lochy, through the sluices at Laggan Locks. The results of this operation, combined with the continued fine weather, was an almost complete drying out of the river bed and the assurance of a few days

Repair of a Breach in the Caledonian Canal Embankment—continued

grace in the event of the weather changing to rain.

At the same time canal labour was set to work felling trees and clearing bushes from the breached embankment in preparation for the work of repair, and arrangements were made with a firm of contractors to provide on hire, at the earliest possible date, an excavator to be used as a dragline and crane and three dumpers. It so happened that there was a condemned swim barge, of about 50 tons capacity, at the Inverness end of the canal, and this was towed through Loch Ness to Kytra Lock, the nearest point to the site where there remained sufficient depth of water to float the canal tug. The barge was then passed through the lock into the half empty canal reach and towed by hand about a mile to the site, through the breach, into the lagoon, and moored in line with the river toe of the embankment. The barge was then scuttled by knocking a hole through the plating.

The excavator, on arrival from Aberdeen, travelled about a mile and a half by its own power from the main road (at the north end of Loch Oich) proceeding for some distance along the tow path to a point where the gradient was suitable to approach and cross the river bed, then down its left bank, and into the river bed again, adjacent to the breach. The machine commenced work by dragging all available material back into the lagoon and filling the hold of the scuttled barge. Thereafter the dragline moved about 150 yards further down the dry bed of the river, systematically stripping a layer of gravel off the bottom and loading into the dumpers which ran backwards and forwards, on steel planking, tipping material over the barge into the flooded gap, and working inwards and upwards until about 2,000 tons had been placed in the breach, up to the tow path level.

At this stage, rain, which had been threatening, began to fall steadily and, as the river was rising, the plant had to be moved to safety, up the newly-formed bank, by a ramp left for the purpose. This was on 12th September.

The gravel thus placed, besides stabilizing the ends of the existing embankment, was now to serve as a firm base on which the excavator (rigged as a crane) could operate in driving a line of steel sheet piling through the bank into the undisturbed ground below, and was also to afford concreting material, on the spot, for forming a concrete bagwork revetment on the river side slope.

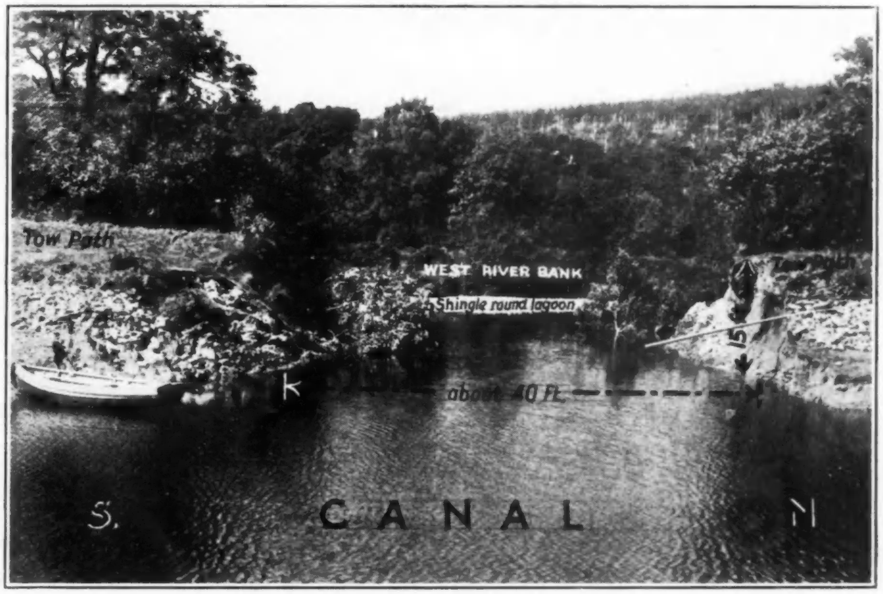
Steel sheet piles had been conveyed, during the period, to Fort Augustus, by road, where they were loaded into a shallow draft barge and towed by tug to Kytra Lock and by hand thereafter to the site, where they were driven by a McKiernan-Terry hammer, suspended from the crane-jib and operated by compressed air from a Diesel driven compressor. Opportunity was also taken of continuing the line of piling for a further distance of 140 feet south of the breach to reinforce this narrow portion of the embankment. About 80 tons of piling was used in all.

Still further material was required to complete the inner face of the embankment, and portions of the scar ends and the canal bottom had also to be made watertight. Fortunately a bank of virgin clay had been discovered about a quarter of a mile away, in the side of the half empty reach, and the canal grabbing dredger, (drawing 5 feet of water) was put to work filling hopper loads of clay. It was possible for some of this material to be dumped without rehandling, at the inner toe of the embankment but the rest could only be dropped in the middle of the canal, opposite the gap, owing to the depth of water required for the open hopper doors. From there the clay was re-dredged and placed for the remainder of the embankment by grab. About 800 tons of clay was required before the work was completed.

During these operations, a small concrete mixer was employed on the river side of the embankment for filling sand bags with concrete, these being laid on the slope, commencing from the hatch-coaming of the barge which had been so placed to form a toe for the revetment.

The surface of the gravel in the hold of the barge was also finally covered with 4 inches of concrete, made by passing the top layer of its cargo through the concrete mixer and replacing it as concrete. The top of the embankment was finished off with turf brought from the opposite side of the canal by barge. The canal was re-opened for traffic on the 21st October, ten weeks after the breach occurred.

It is not known what was the cause of the collapse but the following events had taken place previously, any or all of which might have contributed to the failure.



View of Breach in Bank of Canal.

An enemy aircraft dropped a bomb in the canal about 500 yards from the site of the breach in 1941. There was an earthquake shock in the Great Glen (in which the canal is situated) on Christmas Day, 1946. Eight weeks of severe frost were experienced between January and March, 1947, when the water level in Loch Oich fell to 12 feet below normal, and the River Oich was dry during that time, the canal embankment being exposed to frost action throughout the period. During the months of July and August, 1947, an extremely dry and hot spell of weather was experienced, the canal embankment being thus subjected to a maximum difference of head of water over a prolonged period.

The embankment was constructed over 125 years ago and where the breach occurred, is one of the narrowest separating the river from the canal, the width at normal water level being about 40 feet. The river is approximately 80 feet wide and the canal 110 feet wide at this point.

The success of the repair was due in no small measure to the promptitude with which the contractors got their plant onto the site in the first instance, and to the fact that the fine weather held just long enough to enable sufficient material to be won from the river before it returned to its normal rapid flow and volume.

The work was carried out under the direction of the writer as Engineer and Manager of the Caledonian Canal. The Contractors were Messrs. William Tawse, Limited, of Aberdeen.

The writer is indebted to the Ministry of Transport for permission to publish this paper.

Notes of the Month

New Quay at Casablanca.

The Quai de Rive at Casablanca, which enables vessels up to 130 metres in length to berth, has been taken into use, the first vessel to berth after the official inauguration being the French motor ship *Couesnon* (3,807 tons gross). The quay is provided with five cranes, two of one ton capacity, one of two tons, and two of five tons.

Canal Traffic at Hamburg.

According to figures issued towards the end of last month, an increase of more than 47 per cent. in barge traffic leaving Hamburg for Germany and Czechoslovakia by canal is reported since the Berlin blockade was lifted. During May, 1,048 barges, with 191,280 tons of cargo, used the port. These figures include 16,142 tons of goods leaving for Berlin and 103 Czech barges arriving or leaving with 37,886 tons of goods.

Large Oil Refinery at Fawley.

Work has commenced on the construction of an oil refinery for the Anglo-American Oil Co., Limited, at Fawley, near Southampton. The new refinery which will be the largest in Europe, and one of the largest in the world, will substantially reduce Britain's dollar expenditure for petroleum products and important savings will result from greatly increased shipments of crude petroleum from the Middle East for refining at Fawley. The output of the new refinery will be over 5,000,000 tons a year compared with 800,000 tons at present. This huge plant is expected to cost approximately £37,500,000 and to take about three years to complete.

Pier at Manila to be Rebuilt.

A contract for the reconstruction of Pier 13, Manila south Harbour, which was bombed and severely damaged during the recent war, has been awarded to the Atlantic Gulf & Pacific Company. The contract is estimated to be valued at 1,977,000 Philippine pesos. The repair work includes the installation of almost 5,500 linear feet of H-beam piles, the pouring of about 6,000 cubic yards of concrete to repair concrete piles, deck and beams, and the fabrication and installation of two new mooring bollards and 12 new mooring bitts. In place of the large single concrete and steel building which was on the old pier there will be four in-transit buildings. The reconstructed pier approved will have 675 yards of concrete pavement and a steel grille fence 400-ft. long, and, unlike the old pier, will be intended to handle light cargo and passenger service.

Mexican Port Development.

The Bulletin of the American Marine Institute reports that new ship facilities are to be installed by the Mexican Federal Government on Guaymas Bay, which will be dredged to facilitate the entry of large-sized vessels. At the same time, several additional tankers for transporting petroleum products to Mexican ports will be acquired by a Mexican Company.

Lights and Beacons Conference.

It has been announced that a conference on lights, beacons and navigation aids is to be held in Paris from July 3rd to July 8th, 1950, and will be attended by the heads of the departments of the various countries concerned. The first conference was held in 1937, and it was originally intended to hold them every four years, but the war caused the cancellation of the 1941 session. As radio electric aids have since been dealt with in London 1946, and New York 1947, the agenda for the 1950 meetings will be chiefly concerned with lighthouses, light vessels, buoys, fog signals, etc.

Trade at Israeli Ports.

General cargo discharged in Israeli ports between January and April reached a total of 295,000 tons, 14,000 tons more than in the same period last year. On the other hand, loading decreased considerably—165,000 tons, against 394,000 for the corresponding period last year. There were two reasons for this big decrease. Last year the British evacuation raised the figure, while this year citrus exports have been comparatively low. Haifa was the busiest port, both in exports and imports, and handled a total of 243,000 tons. Tel-Aviv and Jaffa suffered because of bad weather.

Expansion Plans for the Port of Dar-es-Salaam.

Favourable comment has followed the recent publication of a report drawn up by a committee of three railway and port experts into the possibilities of making Dar-es-Salaam into a major port having at least 18 deep-water berths and capable of handling a total of 1,000,000 tons of freight annually. The report was drawn up for the East African High Commission and has now been presented to Sir Reginald Robins, the Commissioner for Transport, for examination. Those interested in the scheme have already pointed out that any expansion of Dar-es-Salaam as a major port must also be accompanied by development of Tanganyika's central railway system, which otherwise would not be able to handle the additional traffic.

International Labour Organisation

(continued from page 91)

to employers' individual requirements, together with centralised payment of wages where desirable. At the same time it was recognised that the occasional use of unregistered labour is essential. The provision of reasonable welfare facilities, where those did not exist, was advocated. Various other ancillary recommendations were made.

The most contentious points proved to be those already referred to in regard to the question of joint administration of schemes and the form of guaranteed payments. It was finally accepted that the differences of opinion and practice were such that no judgment should be attempted as to either of them. On the point of administration, it was agreed only that the best schemes would be the product of collective bargaining, and that they could not operate satisfactorily without effective co-operation between employers and workers. As to guaranteed payments, it was argued, for instance, by the United States employers, that the dockers' wage structure took account of the uncertainty of employment. By others it was held that the provision of a minimum income for workers in general was a function of the State and that, in one or two cases where the Docks Industry had introduced its own system of guaranteed payments, the State to a certain extent subsidised them. These, of course, are arguments very familiar to those concerned with the preparation of the Dock Labour Scheme in the United Kingdom. It was ultimately left that, in the preparation of schemes, regard should be had to the experience of various countries in this matter.

The resolution has been submitted to the Governing Body of the I.L.O. and, if it is accepted, will in due course be transmitted to the Governments of the various participant countries. Incidentally, it is interesting to note that in presenting the Resolution to the main Committee for adoption, the Chairman made the point that one of the reasons why it was desirable that dock labour schemes in different countries should be of a somewhat similar pattern was that the cost was an important factor in international economic competition.

Not the least valuable feature of the Conference was the opportunity it gave for discussions, formal and otherwise, between the delegates from many countries on a problem which, while not identical in any two countries or perhaps even in any two ports, nevertheless is in its essential features common to all sea-going nations.